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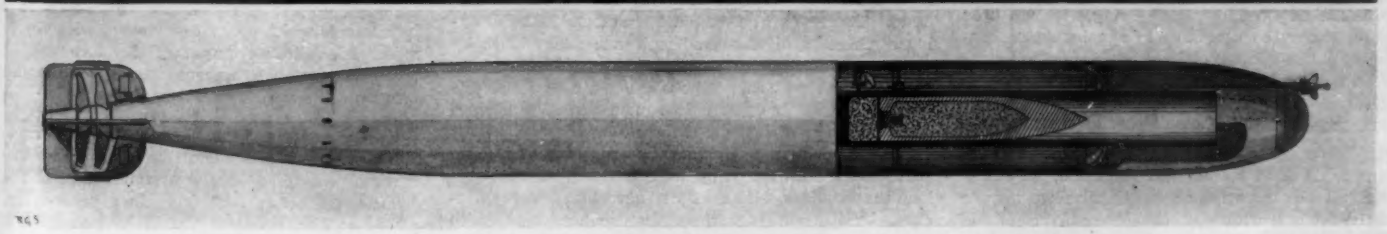

How the Davis torpedo would pierce five opposing bulkheads of steel, passing through one of the coal bunkers and bursting in a boiler room.

A NEW FORM OF UNDERWATER ATTACK.—[See page 94.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Wanted—A Chief for the Bureau of Chemistry

MONTHS have now elapsed since Dr. Wiley resigned as chief of the Bureau of Chemistry. That no successor has as yet been appointed may be attributed to the fact that it is no easy task to induce a scientist of commanding position and personality to accept an annual salary far less than the sum which he could earn in a year in private practice. Moreover, the conditions under which work is now carried on in the Bureau of Chemistry would be intolerable to any really scientific man. Selfish food manufacturers are bound to do all in their power to make his official life as unbearable as possible, and the spirits that now dominate the work done by the Bureau of Chemistry in passing upon the legality or illegality of the doings of food and drug manufacturers would hardly be in sympathy with a real scientific chief. We cannot imagine that any self respecting scientist who has a reputation to sustain would be willing to accept the position without absolute power to reorganize the entire bureau, and to shape its investigations in such a way that its work will be respected. Yet, not until a thorough reorganization is effected, not until the old meaningless divisions of the Bureau of Chemistry are abolished, not until the rank and file of the Bureau of Chemistry realize that at last they may work with the impersonal, unbiased, open minds of chemists in a university laboratory of the highest standing, is it likely that the Bureau of Chemistry will become a truly effective and valuable institution. When that reorganization is effected it will no longer be necessary to maintain at an expense of tens of thousands of dollars per year a referee board to check up the work of the Bureau of Chemistry. As matters now stand, the Bureau of Chemistry has the lamentable distinction of being the only department of the Government that cannot stand on its own scientific feet, and that requires scientific supervision by another body.

At present wealthy dishonest food manufacturers find it no difficult task to escape the punishment which they so richly deserve. Opposed by well meaning but incompetent employees of the Bureau of Chemistry they find it no difficult matter in Court to offset their unscientific evidence by expert testimony, which can be bought at a market price, and which is at least as good as the evidence offered by the Government. That is why the admirable Pure Food and Drugs Act is not at present as effective as it should be. Not until a strong man is appointed, a man who realizes the enormous responsibility of caring for a nation's health, will that excellent piece of legislation become what it should be.

Scientific men naturally shrink from the kind of publicity which the reorganization and administration of the Bureau of Chemistry will bring with it. For that reason it may be necessary to appoint some fearless, honest, public-spirited civilian, who is in full sympathy with the ideals and methods of scientific men.

Interference and Aeroplane Disasters

THREE very recent accidents to aircraft have furnished food for serious reflection, and they are all the more important because we appear to be on the eve of a wide adoption of aeroplanes of one or another form for military and for naval uses. In addition to this, these mishaps are likewise lessons to the aviator generally. In brief, we are brought face to face with the fact that speeding aeroplanes are a danger to one another even though maneuvering at apparently safe distances.

On the 20th of June, Mlle. Helene Dutrieu, while driving a monoplane at Aix-les-Bains, hit an "air hole," as the descending air current has been nicknamed, and fell to the ground. Her fall, however, was checked by her machine landing on top of two other monoplanes ascending at the time, and all three of the aeroplanes were thrown to the earth.

Sixteen days later, at Villacoublay, near Paris, Lieutenants Briez and Burlez, both of the French army, set out on a flight toward Belfort, a point on the eastern frontier. Lieutenant Briez got the start of his fellow aviator, and had reached a height of five or six hundred feet before Lieutenant Burlez overtook him. Lieutenant Burlez was traveling a hundred feet higher up and faster than his brother officer. Just after the upper monoplane swept ahead, a descending column of air—undoubtedly the reaction due to the overhauling and higher monoplane—struck one of the wings of Lieut. Briez's machine and destroyed its equilibrium so suddenly and forcibly that the latter aviator and his aeroplane were dashed to the earth. Lieut. Burlez was thus the innocent cause of the disaster which nearly cost his companion-in-arms his life.

It is quite probable that Mlle. Dutrieu's fall may have been brought about by the aerial perturbations set up below her by the maneuvering of the two lower monoplanes—in this respect the promoting agitation coming from beneath instead of from above as in the case of Lieut. Briez's serious plunge. We do not know what were the speeds of the two disturbing aeroplanes at Aix-les-Bains, but it is not hard to see how doubling the cause of the aerial commotion would naturally promote greater reactions, and the gravity of this under any circumstances might be augmented if the same factor of agitation occurred nearer the ground. This is broadly on the principle that a bodily displacement of the air, as that occasioning sound, for instance, will carry its effect higher than a similarly disturbing force exerted at greater altitude and transmitted downward. In the case of the Burlez-Briez accident; we are left to speculate as to what might have occurred if the lower rather than the upper monoplane had overhauled and passed onward at greater speed.

Only a few days ago, the Italian aviator, Guidoni, while maneuvering his hydro-aeroplane aloft in the Gulf of Spezia, drove his machine across the wake of the battleship "Dante Alighieri," which was at that time making about twenty-three knots an hour. The high speed of that battleship created such perturbations in the air that Guidoni's machine, although some distance astern, was capsized and tumbled into the water. This is especially suggestive to the naval man, because the use of the hydro-aeroplane is proposed in conjunction with sea-going ships as mobile launching and landing places for these hybrid scouts. The tumble which Signor Guidoni got under auspicious conditions of wind and water does not prophesy favorably for the employment of aeroplanes with moving vessels and in more boisterous circumstances of wave and weather.

But what all three of these illuminating mishaps emphasize is the wide zone of disturbance set up by the reactions of the air following a moving body. Model basin experiments and the influence of ships in motion have given us convincing evidence of the force of the suction created between neighboring vessels under way. Because of the denser character of the medium supporting floating ships, it is reasonable to suppose that the action of readjustment of the surrounding water is confined to a relatively restricted zone when compared with similar disturbances created in the air. And yet we know that moving craft have affected one another by suction when separated several hundred feet. Because of the compressibility and the far lesser density of the air, it must be plain that a flying machine—not a balloon—is drawing for support upon a much wider atmospheric zone than a similar weight borne upon the water's surface. Again, the compressibility of the air is a prime factor in sustaining a heavy body in motion aloft, and the re-expansion of this air in the wake of the aeroplane must produce perturbations which carry their influence correspondingly farther because of the very nature of this medium. Therefore, at first blush, it seems that the flying machine in flight must be given a wider berth by another aeroplane than heretofore imagined. The question is, what will this impose when air craft of this sort undertake to operate in squadrons? Formations of this kind may logically follow the adoption of the aeroplane gun.

It has been intimated by some students of this problem that the propellers of the aeroplanes were principally responsible for these disturbances leading to the formation of falling columns of air, otherwise popularly known as "air holes" or "air pockets." That there is good reason to doubt the entirety of this perturbation being due to the propellers has been disclosed by the towing tests of models in the experimental basin. The researches of this character have shown pronounced suction to exist between models of vessels without screws, and Naval Constructor Taylor has declared his belief that the propeller is not a momentous factor in promoting suction. Is it not likely that a somewhat kindred contributive relation exists between the propeller of a flying machine and its supporting planes which are being driven more or less bluntly against the opposing and sustaining air? Again, it is contiguous to these surfaces that the air is subjected to its greatest compression, because there are the points of suspension, and may not the reaction of the wake of these planes cause the greatest measure of the vertical agitation of the atmosphere? These recent accidents suggest a line of experimental investigation which might be pursued with much profit to the art of aerial navigation. Certain it is, the import of these casualties can not rightly be ignored.

The Protection of Mountain Observatories from Lightning

NOWHERE else do the electrical discharges of the atmosphere assume so intense and terrifying a character as on the summits of high mountains, and the danger of lightning stroke is one of the formidable obstacles to the successful operation of mountain observatories. In a recent number of the *Comptes Rendus*, M. J. Vallot, the well-known founder of the Mont Blanc observatory, publishes a graphic description of these dangerous phenomena and some suggestions for averting their effects.

It is a mistake to suppose that the insulation afforded by snow suffices to protect from lightning. This fact was illustrated last August, when the laboratory of the Society of Observatories, built on the summit of Mont Blanc, was struck by lightning, with fatal results to one of its occupants. This building is of wood, roofed with sheets of copper, and is not provided with lightning rods. It was practically buried in snow at the time of the disaster. The same building was struck in 1909, although it did not then have a metal roof.

The famous Janssen observatory on Mont Blanc was repeatedly struck, although it bore numerous lightning rods, connected by cables to some rocks a few hundred feet distant. This building was of wood and was built on the snow. The effects of the lightning were extraordinary and appalling; the metal tableware was frequently melted or perforated; the bolts and nuts in the walls were melted; the woodwork charred; the metal cap of the large telescope was pierced with holes, etc.

In 1903 a guide, one Felix Bozon, witnessed a brilliant electrical discharge in the form of ribbons of fire which for two hours and a half continued to play across the interior of the building, proceeding from one of the cables connected with the lightning rods. In 1902 a ball of fire as large as a pigeon's egg was seen to move slowly across the room, then retreat for a distance and explode, giving a violent shock to the persons present. In 1907 a series of lightning strokes occurred one evening at nearly regular intervals of a few minutes; each stroke produced a deafening noise and was attended by sparks like fiery serpents, which shot through the observatory in all directions. This process continued nearly an hour. Such occurrences appear to have been common at the Janssen observatory, which must have been a far from tranquil place of abode for the savants who carried on historic researches at this elevated spot.

It is evident that lightning rods are entirely inadequate to carry off the enormous discharges of mountain thunder storms.

In contrast to the experiences of the former Janssen observatory, it is most encouraging to learn that M. Vallot's own observatory, on another part of Mont Blanc, has never once been struck by lightning, during its thirteen years of existence. This structure is built on the solid rock, and is completely incased in thin sheets of copper, which are connected with a number of multiple-point lightning rods, grounded in the rock. The whole system of metal thus forms a Faraday cage, which so fully carries off the lightning discharges that even during the most violent thunder storms no electrical effect of any kind is observed inside the building, despite the presence of numerous metallic instruments which are not connected with the lightning rods. M. Vallot's observatory therefore forms a valuable object lesson to anyone who is contemplating the erection of a mountain observatory.

Danger in Metal Wine Vessels.—A note of warning in regard to the use of metal utensils for the measuring, serving, or holding of wine is sounded in the *Moniteur Vinicole* by M. L. Mathieu. In general only copper, plated copper, or silver should be permitted in wine-rooms, cellars, etc., though plated "tin" may be used safely under certain special conditions. Zinc is especially prohibited, since it forms with wine salts which are soluble in the wine, and which not only impair the flavor by lending a disagreeable metallic flavor, but are markedly toxic even in very small quantities.

Science

The Temperature of Flowing Lava was measured during the eruption of Etna last September by Prof. G. Platania with a Fery radio-pyrometer. Where the lava was still glowing red, temperatures ranging from 795 to 940 deg. Cent. were observed.

Uniform Sizes for Scientific Books.—The council of the International Association of Chemical Societies, meeting in Berlin last April, unanimously approved Prof. Ostwald's suggestion in favor of a uniform size, or series of sizes, for chemical publications, and recommended that all the affiliated societies adopt the universal format 16x22.6 centimeters, or a format bearing some logical relation to this. All publications of the Association will hereafter conform to this size.

The Folly of Rain Making.—Prof. Willis L. Moore, Chief of the Weather Bureau, has issued a statement in which he criticises the efforts of a prominent breakfast food manufacturer of Battle Creek to produce rain artificially. "It hardly seems necessary for the Weather Bureau at this late day," says Prof. Moore, "to enter into elaborate arguments in order to convince the public of the utter futility of this and every other method so far proposed for artificially producing rain."

Natural and Artificial Asphalt.—In several European countries, and especially in Austria, artificial asphalt is manufactured and used; but up to the present there has been no direct comparison of the two from the purely chemical standpoint. Recently, however, Gawalowski has made analysis of true Barbados asphalt and of the artificial, with the following results: Specific gravity, natural, 1.0143; artificial, 1.393. Hardness according to Mohs, natural, 1 to 2 deg. M.; artificial, 2 to 3 deg. M. Hardness according to Breithaupt, natural, 1 to 2 deg. B.; artificial, 3 deg. B. Soluble in petroleum, natural, very easily; artificial, with great difficulty, slowly and incompetely. Soluble in benzin, natural, very easily and completely; artificial, with great difficulty, slowly and incompletely. Soluble in benzol, natural, very easily and completely; artificial, rather easily. Solubility in wax, natural, not known; artificial, in 5 to 7 days, leaving an amber-like remainder. The solution in benzin of the Barbados natural asphalt gives a beautiful brownish varnish layer, which dries in about ten minutes; that of the artificial asphalt, however, does not; therefore the first is to be preferred for fine varnish.

The Bulk and Weight of Our Rainfall.—Mr. George A. Lindsay, writing in the Transactions of the Academy of Science of St. Louis, gives some interesting statistics of the rainfall of the United States, not expressed in the conventional inches of depth, but in the aggregate volume and weight of the moisture that falls annually over a given area. To anyone who is familiar only with the customary method of stating rainfall, it is somewhat startling to learn, for instance, that 43.9 cubic miles of rain fell in Missouri during the year 1896. This is decidedly more impressive that the statement that the rainfall was about 40 inches. In the same year 1,296.4 cubic miles of water is computed to have fallen over the whole area of the United States, and the average annual rainfall is somewhat greater than this; viz., 1,308 cubic miles, weighing 6,000,000,000,000 tons. As an illustration of the fact that most of the water that falls as rain never reaches the sea through the medium of drainage, but is evaporated from the land, Mr. Lindsay shows that the discharge of the Mississippi River at St. Louis is but little greater than the volume of rainfall over the State of Missouri alone, despite the enormous area drained by the river above that point.

Street Dust and Street Pavements.—In a recent article published in *Hygiene* Dr. Rasser draws attention to the considerable danger connected with street dust, the action of which on the human organs of respiration is responsible to a great extent for the origin of tuberculosis and similar diseases of the lungs and wind-pipe. But apart from this kind of trouble, dangerous chronic inflammations of the eye should be put down to the action of street dust. In fact, an increase in the frequency of catarrhs has been observed with continued dry weather and a reduction on the occurrence of the first rain. Under these conditions road engineering, apart from its technical task, has primarily to fulfill a sanitary task. As the production of dust depends on the fixing of roads, a pavement complying with all hygienical requirements should be looked for. Asphalted streets would seem to comply with most of these conditions, provided there be an extensive and thorough removal of waste matter followed by an abundant sprinkling of the road surface. Caoutchouc pavement, as used with especially satisfactory results in London, would seem to be most desirable. Dr. Rasser does not seem to think very highly of the sprinkling of roads with chemicals, such as salts and tar. An ideal means of laying street dust which has been suggested of late years is sprinkling with a solution of sulphite pitch in water, which would seem to avoid any dust for at least six weeks. Sulphite pitch is obtained as a by-product in manufacturing cellulose.

Electricity

Electrical Irrigation.—At Good Ground, L. I., Mr. Emilio Olsson is conducting some experiments with his system of irrigation, described some time ago in the Inventor's Department of the SCIENTIFIC AMERICAN. The poorest soil in Good Ground has been selected for the test. One plot is irrigated with water alone; a companion plot with water electrically charged, according to the Olsson system. The results of the comparative growth will be watched with interest.

An Electrically Fired Iron Furnace.—The electrical production of pig iron has been tried from time to time in Scandinavia, the poor coal supply of the country and the availability of cheap electric power inviting such experiments. In a powerful reducing plant erected at Trollhätten, investigations lasting six months have recently been concluded. The energy was supplied at 10,000 volts, three-phase, and transformed to two-phase current with a pressure variable in each phase from 50 to 100 volts, and currents of 3,000 to 18,000 amperes were employed in the furnace. The best result attained was 2,241 kilowatt-hours per ton of iron cast, of which 1,596 kilowatt-hours was expended in useful work, showing an efficiency of 71.77 per cent. The furnace is designed to produce 7,500 tons of pig iron during eleven months of the year.

Communication with Railroad Trains by "Railophone."—A demonstration of the "Railophone," an invention for actuating signals and effecting other mechanical operations on moving trains, was recently given on an English railway. Briefly the system comprises an insulated wire laid alongside the track and connecting to apparatus at signal cabins and stations, and of a pair of coils wound on frames around the railroad cars, one for sending and the other for receiving. The system operates by induction, and an essential feature is a relay which can only be operated by the periodic impulses which convey the signals and is not affected by the non-periodic vibrations caused by the movement of the train. Among other feats accomplished during the tests were the stopping of a train which had been allowed to run past a danger signal and the transmission of a message and its reply between a station and the train.

The Hamburg Electric Railroad.—The new Hamburg elevated and underground electric road is a remarkable piece of engineering and electrical work and represents the most recent progress on the continent. It is made up of viaducts and bridge structure for about one third the length, and a quarter of the length is underground. The remainder is built of embankments, in part, between masonry walls. Trains are made up entirely of motor cars, each one having two 100 horsepower motors, and the controlling can be done from each of the end cars. The total length of the line is about 16 miles, with standard gage tracks, and the distance between stations is 2,650 feet. The station platforms are 200 feet long. An automatic system of electric lighting is used so that the lights come on only when passing through the underground part. Three-phase current at 6,000 volts is supplied by a special plant at Barmbeck, sent to two sub-stations at the principal station of Eppendorf, where it is transformed to 800-volt direct-current. This is employed on the third-rail system, but the contact shoe works upon the under surface of the rail.

A Marvelous Electrical Discovery.—In a brief and revolutionary monograph presented to the French Académie des Sciences, Prof. Jean Becquerel, the great physicist, announces a discovery which, when it is confirmed, as it certainly will be, will prove to be of untold importance in the practical workings as well as the study of electricity. It is well known that if a thin strip of metal is fastened to a glass plate placed between the poles of an electro-magnet in such a way that the plane of the strip is at right angles to the lines of force of the magnetic field, a current passing through the strip from end to end is deflected to one side or the other, according to the type of metal of which the strip is composed. Thus the current in a strip of zinc, iron, or cobalt is deflected toward the right, but to the left if nickel, gold, or bismuth is used. The effect is especially striking when bismuth is taken to make the strip. From its discoverer, Dr. Hall, of Johns Hopkins University, this has been named the "Hall effect." It has been held as strong evidence that there are such bodies as positive electrons. Dr. Pfund of Baltimore is, together with Sir J. J. Thomson and others, convinced that the presumptive evidence in favor of the existence of positive electrons is too definite for further doubt. M. Becquerel now proves that if the Baltimore experiment be carried out with a piece of bismuth in liquid air, the effect is made more conspicuous. Then, too, if the magnetic field be increased to above 3,500, the deflection abruptly becomes positive instead of negative. This upsets all known mathematical and physical theories that would make the negative electrons the only carriers of electrons in metals. It again changes our views of the question of what negative and positive electricity really is.

Aeronautics

A New French Aero Club.—Blériot, who resigned on July 3rd last from the Aero Club of France, has started a new organization, called the Aviators' Friendly Association. Among his adherents are many famous aviators and designers.

France and the Gordon-Bennett Cup.—There has been much activity at Chalons. The elimination trials for the Gordon-Bennett cup have shown that Vedrines will, in all likelihood, represent France. Recently he covered 200 kilometers (about 120 miles) in one hour and twenty-four minutes.

A Berliner Engine.—Mr. Emil Berliner of Washington, D. C., well known in connection with his telephone and other important inventions, has patented a rotary gas engine which has a rotating crank case carrying a cylinder which rotates with it, and a piston in the cylinder with the ports of the cylinder so disposed as to be uncovered by the piston as it reaches the end of its stroke following explosion.

A New Aeroplane Construction.—Spencer M. Brown of Portland, Ore., has patented an aeroplane, No. 1,032,587, which has a pair of upwardly inclined wings which are united at their lower edges and each of the wings is broken into transversely disposed sections, with each alternating section along the inner edge of each wing inclined upwardly to form with the other section a truss-like framework.

A Sixteen-hour Journey in a Dirigible.—The French dirigible "Conte" has made a trip lasting sixteen hours and twenty-four minutes. Under the direction of M. Cohen the craft left from the vicinity of Meaux and Fontainebleau, returned over Paris in the dead of night, then reached Etampes, Arthenay, and Chartres, finally to return to Issy-les-Moulineaux. The maximum altitude attained was over 6,500 feet.

Resistance Tests With Blériot Machines.—The French military authorities have been making some remarkable tests with Blériot monoplanes. On a special railway train a Blériot monoplane was mounted in such a manner that it could assume all possible positions taken in ordinary flight. The train was driven at a speed of 72 miles an hour over a 5-kilometer stretch of railway.

Investigating Accidents.—The Public Safety and Accidents Investigation Committee of the Royal Aero Club promises to fulfill a useful purpose in the development of aviation. Judging from the celerity with which it proceeded in investigating the accident that occurred recently at Brooklands, in which an aviator and a passenger lost their lives, we may expect to learn more of those weaknesses in construction and defects in handling to which so many deaths are due.

German Military Aeronautics.—The German Minister of War has bought for the army the Siemens-Schuckert dirigible airship. In trials conducted last February the vessel attained a speed of 43 miles an hour. The dirigible "Z-2," stationed at Cologne, a Parseval airship, and fifteen or twenty aeroplanes will take part in the forthcoming maneuvers. The dirigible "Z-3," which was badly damaged at Friedrichshafen, is now completely repaired.

The Blériot Berline.—The aerial taxicab or berline, built for Deutsche de la Meurthe by Blériot, has been making some remarkable flights. The 100 horse-power motor has been removed, and in its place a 140 horse-power engine has been installed. Loaded with about 650 pounds of ballast, it carries a cargo equivalent in weight to that of four passengers besides the pilot. As yet, no four passengers have ventured to take their seats in the taxicab body.

The First Aerial Derby.—The English Aerial Derby showed that flying can be made a real sport. More enthusiasm was invoked over a contest for a 100 guinea trophy and cash prizes of £450 than was aroused even by the $50,000 prizes of the *Daily Mail* in the past. It is safe to say that millions saw the race. At the London Aerodrome, we are assured by our contemporary *Flight*, at least 45,000 paid for admission to the inclosures, while on the adjacent slopes several thousands more were massed. The same state of affairs applied at every point around the course of 81 miles. Hamel, one of the contestants, stated that Esher Common was absolutely black with people.

Guiding Torpedoes from Aircraft.—In patent No. 1,032,394 Bradley A. Fiske, U. S. navy, presents a method and apparatus for delivering submarine torpedoes from aircraft in which the torpedo is first transported through the air to a point of desired proximity to a target by means of an aircraft and then the torpedo is trained in the desired direction, after which the propelling mechanism of the torpedo is started, and then the torpedo is released to fall by gravity to the water. In the apparatus, a strap is employed for retaining the torpedo below the aircraft and a manually controlled lever releases a latch for said strap, the said lever also actuating transmitting mechanism to operate the starting device for the propelling mechanism of the torpedo.

On striking the timber the motorcycle acquires a mounting position.

Position of the machine two feet above the testing track on a ten foot leap.

Machine's position in alighting after striking the timber obstruction.

Testing a Motorcycle

A MANUFACTURER of motorcycles in the Middle West experienced considerable difficulty in his early days with spring forks. He was using a very high grade of steel, but nevertheless the forks would sometimes break in the hands of bicycle users. They employed consulting engineers to find out what was the matter. The verdict was that the spring forks were the best that could possibly be made. One engineer, however, had made a change—not a change in design, but a change in material—substituting a steel somewhat more brittle. That seemed very foolish. In order to prove to the manufacturer that he was right, he offered to test the motorcycle in the manner shown by the accompanying illustrations. He rode around a test track, banked at the turns, at a speed of five to sixty miles an hour, striking an obstruction (a four by four timber). Every time the motorcycle encountered the obstruction it leaped into the air approximately two feet and alighted ten feet farther on. The test is now being performed by several testers daily.

Transatlantic Wireless Telegraphy Without Antennæ

HUGE towers for carrying up the antenna system to sufficient height above ground have been built at several places, e. g., Poldhu, Clifden, Glace Bay, to make transatlantic radio-telegraphy possible. The highest building in the world, the Eiffel Tower (about 1,000 feet in height), has in its turn been utilized for the purposes of wireless telegraphy, while the sending tower of the Nauen radio-telegraphic station was recently raised from 330 feet to 660 feet in height, thus allowing the African colonies to be reached from Berlin by wireless telegraphy.

It will therefore be readily understood that experiments recently made in Berlin with a new arrangement due to Prof. Zehnder should arouse more than usual attention. The new scheme, in fact, does away with any antenna. An ordinary insulated conductor wire carried on telegraph poles is connected at both ends to the ground, with or without the intermediary of Leyden jars. The total length of wire between the two ground connections should at most equal one half wave length of the alternate current employed. If, for instance, the wave length in air be 4,500 meters (2.8 miles), which is about sufficient for transatlantic operation, the ground connections would have to be located at 900 meters (2,952 feet) apart in the ground and only 250 meters (820 feet) in water. This conductor is excited as usual in its central part by a Braun vibratory circuit, the length of which is turned to the frequency of the vibratory circuit.

This new scheme at the same time constitutes a system of directed wireless telegraphy, the direction of the wire itself being the most favorable for sending. In a like manner, if a receiver be substituted for the exciter, the preferential receiving direction will be given by the wire.

This scheme, in spite of the provisional character of the arrangement, allowed telegrams to be sent with small-size sending apparatus and without antennæ, to many hundreds of miles. Herr Kiebitz, of the German Telegraph Department, in his experiments on behalf of the department transmitted radiograms from Berlin to Norddeich and with the ordinary type of receiver, received in Berlin messages that came across the Atlantic Ocean from Glace Bay, Nova Scotia.

One advantage of the scheme suggested by Zehnder is the possibility of installing the whole of the apparatus in the interior of a building, fortress, man-of-war, etc., thus protecting it against destruction by storms, gales or the enemy's guns, which will be found of inappreciable value in warfare. Incidentally these experiments appear to show that the transmission of electric waves in great part occurs through the earth itself.

The Curtiss "Flying Boat"

A New Type of Hydro-aeroplane

SINCE he closed his camp and aviation school at San Diego last spring, Glenn Curtiss has been steadily at work at his home in Hammondsport, N. Y., making further improvements upon his hydro-aeroplane. The result of his recent experiments is shown in the photographs reproduced on this page, which give a good idea of his latest combined boat and biplane, known as the Curtiss "Flying Boat."

This boat is a single step hydroplane, 26 feet long, 3 feet wide, and having sides 3 feet high. It is surmounted by a regular Curtiss biplane, having planes of 30-foot spread by 5½-foot depth between the planes. The planes contain a total supporting surface of about 320 square feet, and support, when in flight, a total weight of about 1,000 pounds. As many as four people can be carried comfortably. One of our illustrations shows a man in a bathing suit lying on the deck of the boat behind the planes in addition to the pilot and passenger in front.

The power plant consists of an 80 horse-power Curtiss 8-cylinder, V-type engine and single propeller mounted high up between the main planes at the center. The motor is mounted sufficiently high to provide a liberal clearance between the end of the propeller blades and the boat, the propeller being just back of the main planes, as usual.

Above the tapered hull of the boat, at the rear, is a vertical fin terminating in a large vertical rudder. The tail is placed about half way between the boat and the top of this fin, and extends out on each side of it. The horizontal rudder consists of two hinged flaps at the rear of the two halves of the tail. No front elevator is provided, so that the pilot has a clear view in front over the spray hood that is fitted. The balancing planes are at the rear, half way between the main planes. Inclined cylindrical floats are fitted below the ends of the lower plane in case the machine tips in making a quick turn on the water.

This new flying boat of Curtiss's makes aviation perfectly safe, as one can travel 50 miles an hour on the surface of the water, or 60 or more miles an hour a few feet above the surface. It will open up to the motor boat enthusiast heretofore unnavigable streams. In fact all the unused canals and shallow rivers of the country can be skimmed over always with complete safety by the yachtsman-aviator.

The passenger lies well to the rear.

The new Curtiss hydroaeroplane in flight.

The Current Supplement

IN the current issue, No. 1909, of the SUPPLEMENT, Dr. Gradenwitz gives an illustrated account of the manufacture and testing at high tension of porcelain electric insulators.—W. R. Ingalls, the well-known metallurgist, writes on the electric smelting of zinc.—Our Berlin correspondent gives a description of the new railway station in course of construction at Leipzig, which, when completed, will be the largest in Europe.—Dr. Zahm concludes his excellent article on aeromechanics.—An instrument by means of which the blind are enabled to perceive light through their sense of hearing was recently exhibited by M. Fournier d'Albe, of Birmingham, England, at the Optical Convention. An account of this is given in the current issue.—Some very excellent points are made with regard to the Oldfield bill in comment reproduced from *Metallurgical and Chemical Engineering* for July.—A new method of preserving eggs, which is said to possess altogether superior merits, is described by our Paris correspondent.—The closing article deals with experiments on the durability of tool steel.

A New Andean Railway

THE American minister at La Paz, Bolivia, reports that on May 15th the railway recently built from Potosi to Rio Mulato, a station between Oruro and Uyuni on the main line, between La Paz and Antofagasta, was officially opened at Potosi by the president of the republic and his cabinet. This railway, surveyed, planned and built by American engineers and contractors, is regarded as a marvelous piece of construction. At one point the altitude is about 16,000 feet, making it, the minister states, the highest railway in the world. Not only was the road very costly to build, but it will be costly to maintain, apparently out of all proportion to its prospective business. There is not a village or hamlet between the terminal points: and Potosi, which had once a population of 200,000, has now fallen to 25,000.

Rebuilding Messina

AFTER the great earthquake of December 28th, 1908, which completely destroyed the city of Messina, the few survivors, aided by international philanthropy, erected temporary wooden buildings south of the old city, and here commercial and official business has since been carried on. On the original site of Messina not a single building had been erected or even begun up to the end of last year. Now, however, preparations for rebuilding the city are well under way. Since July, 1911, the systematic removal of the débris from the streets has been in progress. The plan of reconstruction includes a raise in the level and an extension of the harbor front.

From Clay to Bronze

The Craftsman's Part in the Art of Sculpture

By C. H. Claudy

"THE clay is the life, the plaster death, and marble the resurrection." A famous artist's words, descriptive of the forms through which a statue must pass, whether it end in the white marble which is so poetically referred to above, or in the sterner and more enduring bronze of the heroic size statues, too big for marble work.

Everyone knows, of course, that a statue is first made in clay by the sculptor, whose fingers, tools and skill work out the likeness, the life—sometimes the soul—of the subject. Then, in some way, usually passed over by the expression "casting," the clay is reproduced in bronze. Of the intermediate steps, the general public knows little, yet those intermediate steps are of the utmost importance and of great interest. It is in them, as well as in the casting of the molten metal, that the craftsman steps in and replaces the artist—the place where the most highly skilled labor is necessary, and where the greatest artistic skill in statue making has no value.

When the wet clay, preserved from day to day by being constantly shrouded in wet cloth, is finished and has the lifelike form of the subject to the utmost of the artist's expertness, the craftsman prepares to make a mold from the clay. This mold is not used to make the bronze cast, but it is intended to be employed for making a plaster cast of the clay. From this plaster cast, the final mold is made in which the bronze, streaming and hot, is poured. The great interest in this operation of making the plaster mold and plaster cast comes from the fact that there is no retracing the steps once made—no second chance if the first one fails. To make the mold, the clay is first stuck full of thin pieces of tin! This apparently disastrous proceeding is necessary, for the mold, when made, must be in two or more pieces and some division between the two is necessary. So many thin pieces of tin are used, and are ruthlessly stuck into the clay, forming raised partitions along what are to be the division lines of the mold. The strips overlap and project six inches from the clay. The clay is then wet down and then covered with a thin, cream-like plaster of Paris mixture, which has been highly colored with some pigment; it makes little difference what color it is, so that it is easily distinguished from white. The reason for this first colored layer is seen later on. The liquid plaster is sprinkled and thrown on the clay statue, the greatest care being taken to cover every part of it completely, and to have the liquid penetrate into all the folds, crevices and indentations of the clay. On the skill and care with which this is done depends the success of the mold.

As soon as this first colored layer has been finished, and set, it is built up to a thickness of perhaps an inch with thicker plaster of Paris, uncolored this time. Next, a framework of pipes, wood, wire and rods is erected about the statue in such a way that each part of the mold, as indicated by the division lines of projecting tin, has its own set of braces. Once these are in place, the making of the mold proceeds rapidly, with an assistant mixing plaster of Paris in a bowl, and the craftsman-caster throwing and kneading the wet masses onto the plaster covering the clay, being particular that the mold is built up the thickest where the most strains will come, where it may be five inches or more thick, and permitting those portions where little strain may come to remain not more than an inch or two thick. The iron rods and pipe frameworks are well embedded in the plaster so that they, themselves, will take most of the strain when it becomes time to lift or move parts of the mold.

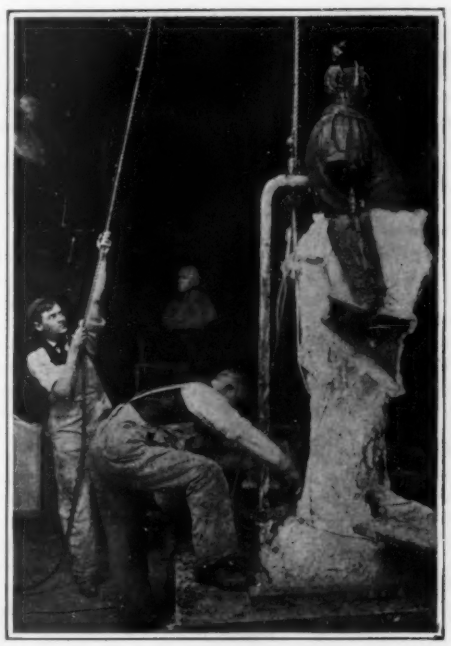
When the caster is through this part of the work, the whole is allowed to dry or set for at least twenty-four hours, and frequently longer. Next is the important and delicate operation of removing the molds from the clay. The delicacy of the process comes in because the molds do not always "pull," that is, to get the molds off, it is necessary to break the clay and to destroy it; in one of the pictures the caster (who, in this case, is also the sculptor) is removing the back pieces of the lower mold of the heroic size statue. The coat tails have been broken off in the mold, and the clay composing them must be dug out by hand, and with streams of water. The picture also shows the destruction wrought in the arms of the statue, the molds of which ruined the clay in being taken off.

When the various pieces of the plaster mold are all removed, they are cleaned thoroughly of all clay, washed out and finally anointed with a specially prepared grease which will prevent the plaster which forms the cast to be made, from sticking. They are then assembled in place, ready for casting. In so large a statue as forms the subject of these photographs, no attempt is made to cast the whole in one piece; the legs and half the trunk form one piece, the head and chest another, the two arms are cast separately, and so on. In order that the several parts should fit one another accurately, the molds are fitted together as the casts are made, and "key joints" are constructed, the raised or "dowel" part of the key being formed on the first cast made while it is still in the mold (and is covered with grease) so that the second cast when made shall form its recess or female part of the joint, thus insuring an accurate fit. The pouring of the plaster for the final cast is also a delicate operation. The plaster must not be too thin, or it will run away from some parts of the mold and settle in other portions; it must not be too thick, or it will not run into all parts of the mold. The casting must proceed uninterruptedly for each set of molds, or it may not come out a homogeneous mass. Generally, the molds, bound together with rope and wire, are turned about as the plaster is run in, to be sure of getting an even and complete casting. The molds are not filled with plaster, as that would not only make the cast very heavy, but give it an excellent chance to split from strains incident to hardening. The walls of the plaster cast, like those of the mold, are from four to six inches or more thick, but a hollow space is always left in the trunk and legs and arms of such a statue, so that in drying there is plenty of room left for air

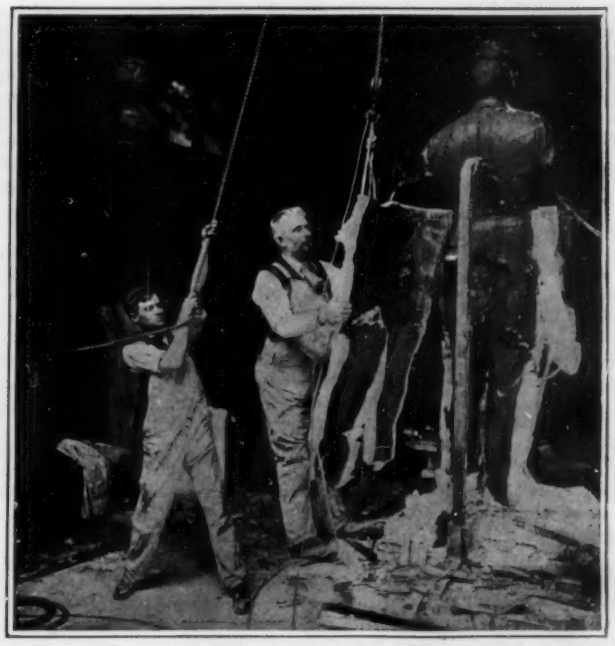
The finished plaster cast.

Fitting key joints together.

Plastering the molds.



The operation of loosening the molds.



The operation of taking off the molds.

to penetrate and get to both sides of the cast. When the molds are all cast, and the whole has dried a sufficient time, comes the most delicate part of all—getting the molds off the cast. For these will not pull from the plaster cast any more than they did from the clay. In this case, however, it is not the cast but the molds which are broken in removing them, and now the significance of the colored layer in the mold becomes apparent. The caster, working away at his molds with mallet and chisel, is safe so long as only white chips fly; as soon as he gets to the colored layer, he goes most carefully, knowing that immediately beneath it lies the cast. The molds are taken off in many pieces and thrown away; their function finished, what remains is a plaster cast, exactly like the original clay, which may be shipped away to the bronze factory (as the clay could not be shipped) there to have molds made in many pieces into which the bronze is poured.

Large statues like the one illustrated take several days to cast both mold and plaster cast, and at almost any time, the labor of months of sculpturing may be ruined by careless work. Of course, molds are broken in making and statues in plaster are chipped. These accidents are not necessarily ruinous, as breaks in either mold or finished cast can be repaired. But the destruction of the clay that the plaster mold may be made, the destruction of the mold that the plaster cast may emerge, like a butterfly from the cocoon, is a delicate operation, and one mistake in the caster's art or one slip of the chisel may mean, if not destruction, at least grave danger to the success of the whole. Hence it is that the craftsmanship of the caster takes for a while the place of the artist, and becomes as much a necessity to the production of the finished likeness as all the skill within his fingers.

A New Form of Underwater Attack

A Torpedo that Carries a Gun

By Robert G. Skerrett

WITH the exception of some ships now building or planned, the thousands of tons of armor plate carried upon modern fighting craft are designed exclusively to combat passively the attack of various types of gun-fired projectiles. Below the load-line, these vessels depend for security upon the surrounding water, so far as the attack of artillery is concerned. The torpedo has commonly in the past been considered so limited in its range and so uncertain in its performance that but little weight has been attached to it by the partisans of the gun. Battle ranges seemed logically to keep the torpedo in the background, except at night, when the speedy torpedo-boat counted upon getting near enough to launch its weapons with a more reasonable promise of getting home a hit. The naval constructor, accepting the torpedo at its potential value as seen by the majority of the fighting officers, simply limited his efforts to frabricating the under-body of his fighting craft so that the damaging effects of a chance blow from a torpedo should be confined to a restricted area. Hence the inner and the outer bottoms, and the water-tight, cellular divisioning of the intervening space. As a matter of fact, the naval constructor's work stood up under torpedo attack and performed its function remarkably well. It is a matter of record, that the general run of torpedoes fired during the Russo-Japanese war did far less damage than was expected of them, and a goodly number of vessels so struck were not sunk as was counted upon, but were able to get into port and be repaired.

There were ships lost to both belligerents by subaqueous attack, but the most conspicuous of these disasters were due to the violent blows of passive mines. Where the active torpedo had failed in its mission the anchored, floating mine filled the offensive gap. These mines carried larger explosive charges than the torpedoes then in service, and proved two things: First, that the naval constructor had planned well, and, second, that the automobile torpedo must needs be made a more powerful weapon if it were to fill the office intended for it.

In the Russian fleet at Port Arthur were several vessels that had been built by the French for the Russian Government. In addition to the usual compartmenting of the inter-bottom space, the French designers had reinforced the region most likely to be attacked by torpedoes by means of a caisson built of plating nearly two inches thick. The object of this caisson—assuming that the explosion of the torpedo should be sufficient to rend or rupture the plating of the inner and outer bottoms—was to provide more space in which the guncotton gases could expand and dissipate the most dangerous percentage of their remaining force. The ingenious theory of this style of construction was proved to be all that its originators claimed for it. The Russian ships so built were several times hit by Japanese mines, and, while greviously wounded over wide areas of their under-bodies, yet the caissons remained substantially intact, and the vessels were able to return to harbor. The Russian and the Japanese battleships that were sunk by means of mines went to the bottom suddenly, because the force of the bursting mines was sufficient to detonate the neighboring magazines; but it is not believed that the vessels lost in this way had the protection of caissons immediately next to the double-bottom space.

The immediate result of the lessons taught by the Russo-Japanese war—so far as they concerned underwater attack—was a widespread realization that the automobile torpedo would need some radical modifications if it were to make good in the future. Apart from the desirability of greater speed and greater range, the most conspicuous need was the power of delivering a more damaging blow when once in contact with its target. To that end, the size of the weapon was progressively increased in order that it might carry a bigger bursting charge of guncotton in its warhead. This desideratum has been realized; but the bursting charge of the biggest of the present day automobile torpedoes is not as large as that of the mines which damaged the ships of both belligerents during that conflict.

As a matter of fact, the more recent dreadnoughts have the under-water protection of the caisson or its equivalent, and one can't help but ask, "How does the increased charge of the warhead meet the requirements of to-day?" In addition to this, armor is being added to the defense against torpedo attack, and this is placing the underwater weapon at a still further disadvantage. Its chances of spreading havoc deep enough to affect a ship's vitals are more remote relatively to-day than they were during the struggle between the Russians and the Japanese. It is manifest that there is a big gap in this line of attack which the Whitehead and its various kindred rivals cannot fill, and here it is that the genius of an American, Commander Cleland Davis, of the United States Navy, provides us with an answer and places the torpedo upon a new and a more formidable footing.

Commander Davis has blazed a new path in the art. He has abandoned the guncotton warhead, which has been the accepted instrument of destruction since the inception of the Whitehead, and has substituted a gun in its stead. If one will study carefully the photographs of either bursting submerged mines or exploding automobile torpedoes, the most impressive visual sign of the violence exerted will be found in the great volumes of water blown heavenward. The water has yielded more than the steel structure attacked, and the major part of the energy designed to wreck has spent itself uselessly in blowing hundreds of tons of water into the air. Commander Davis has sought to so concentrate the powers of assault in his torpedo that but little of its force should be dissipated in disturbing the surrounding water while the bulk of the energy of his weapon should remain unimpaired and centered in piercing the enemy's defenses and penetrating to the very vitals of the object of attack. Commander Davis does not discount in the slightest the truly remarkable developments which have taken place in the other departments of the automobile torpedo. Increased range, higher speed, and more precise functioning all help him toward his objective; but it is his invention which makes this underwater projectile a graver menace to the biggest and the best of fighting craft.

The Davis torpedo, recently tested in the waters of the Lower Chesapeake, carried an 8-inch gun capable of expelling an 8-inch projectile with a muzzle velocity of something like a thousand feet per second. Ordinarily, an 8-inch gun strong enough to fire a shell with this velocity would be far too big and too heavy to be placed within the permissible limits of a torpedo. We are speaking of a piece of ordnance to be fired in the open air. Now, the Davis gun, when fired, is surrounded by the sea, which, so to speak, reinforces the walls of the gun, but this is not all. The weapon is made of vanadium steel, which has a very high elastic limit, and this great strength on the part of the metal makes it possible to construct a gun of seemingly ridiculous lightness. This fact has made the new torpedo practicable.

The muzzle velocity of a thousand feet a second is quite enough to carry the projectile through a single plate of Krupp armor, something like four or five inches thick when virtually in contact with the muzzle of the gun—as would be the case with this torpedo. Now, ships are not protected under water with plating of these dimensions, and it would be a much easier task for the projectile to pass successively through a number of thinner plates even if their combined thickness were more than the limit set. The projectile fired from this new torpedo carries a bursting charge of high explosive of between 35 and 40 pounds. This charge is detonated by a delayed-action fuse, which is designed to meet the maximum requirements imposed by the best protected dreadnoughts built, building, or projected. Our illustration represents the Davis torpedo attacking a ship of the Danton type of the French navy; vessels that typify recent practice, and which have the protecting caisson that saved some of the ships of the Port Arthur fleet from sinking when they hit the Japanese mines planted outside of that port. In our picture we see the shell piercing the five opposing bulkheads of steel, passing through one of the coal bunkers, and bursting in a boiler room. We must leave to the imagination the dreadful aftermath of this attack and the destruction of a boiler charged with high-pressure steam. The same shell might have hit either farther aft or farther forward and bored its way right into a magazine or a shell room, the consequences of which would be even more appalling. The disturbed water has been occasioned by the escaping propulsive gases from the gun, which have served to tear a big rent in the outer plating of the bottom of the ship, and the liberated air from the torpedo's air flask. The surface disturbance is very modest compared with that which either a submarine mine or an automobile torpedo of the usual types would produce.

The diagram under the picture represents the Davis torpedo, and shows a longitudinal section through only that part where the gun is installed. When the weapon has been launched upon its sinister errand the little propeller at the upper side of the torpedo's nose revolves and releases the tripping rod, so that the torpedo can be discharged upon contact with its target. When the rod hits the obstruction it is driven backward and engages the trigger which first compresses a spring attached to the firing pin and then releases it so that the pin can strike the gun primer, thus setting off the propelling charge of powder which drives the shell out of the gun. As soon as the projectile hits the outside plating of a ship's bottom the fuse in the base of the shell begins to function, being set to explode the charge in the shell so many hundredths of a second after impact. During the recent tests in the Chesapeake, the projectile first pierced the target from side to side, passing through a couple of armored bulkheads en route, and then exploded in the water beyond. The second attack was against that side of the target which was further protected by a plate of three-inch steel. The shell exploded at the instant of impact, and did not pass into the target, but the structure was so damaged that it sunk shortly afterwards. The lesson of the second attack laid stress only upon the fact that the fuse was not properly timed, otherwise the shell would have entered the caisson and exploded inside, doing still more damage. This is merely a matter of refinement, and does not qualify the startling possibilities which the Davis gun-torpedo suggests. In the future, in order to safeguard ships against attack of this sort hundreds of tons more of armor must be placed upon every fighting craft, and this must add greatly to their displacement and their cost, or be provided at a sacrifice of other vital features.

The Fire Sprinkler—Plain Business Proposition

FIRE COMMISSIONER JOHNSON, of New York, says: "As a business proposition the most effective fire prevention appliances which the Fire Department can order installed mean dollars saved to the owner of the large factory or other place of business. I refer to automatic sprinklers. Fire prevention experts agree that automatic sprinklers, coupled with a device for sounding an alarm direct to fire headquarters, form the best known method for preventing destructive fires. Experience of many years shows that automatic sprinklers rarely fail to hold fire in check until the department apparatus arrives to put on the finishing touches." In two thirds of these cases the fire is completely put out by the time the department gets there.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Typewriter Ribbon

To the Editor of the SCIENTIFIC AMERICAN:

Please allow me to suggest the following method of making typewriter ribbon.

The base of the ribbon is the so-called "seam binding," which may be obtained at any dry goods store. It is about one half inch in width, thin, and of fine texture. The white should be purchased.

Lamp-black is thoroughly incorporated with castor oil by grinding in a mortar. This is brought to the consistency of thin paint with alcohol. The ink is applied with a cloth or brush. Oil-soluble colors may be used instead of lamp-black.

Lincoln, Ill. C. C. KIPLINGER.

Gyroscopic Action in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

With all due deference to Mr. Jerwan's experiences (as related in Correspondence, April 20th) it seems rather peculiar that simply because a gyroscope is in an aeroplane it should defy the laws of nature.

The Blériot machine of which he speaks would naturally circle in whichever direction it is started, because the center of gravity is behind the wheels, so that the centrifugal force throws the tail out. It might be started in either direction in many ways, such as a side gust, untrue wheels, or a slight turn of the rudder. It might be started to the left (with right-hand propeller) by the drag of the torque loaded wheel or gyroscopic action *while the tail was rising.* The latter would be momentary, and after the tail had risen it would tend to make the machine travel straight rather than circle.

Toronto, Can. CANADIAN SUBSCRIBER.

Politics and Good Roads

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest your article in the SCIENTIFIC AMERICAN of May 11th, 1912, on road conservation. During the last six years I have traveled over many miles of roads in nearly all the Eastern States, and have watched with a great deal of interest the great increase in road building.

It is a delight to travel over a new State road during the first year of its life. The second year the delight is considerably less. The third year you are tempted to take to the open fields, so terrible is the going.

By this time the road needs rebuilding in most cases, and this means a fat contract.

To me this has always been the explanation of why no attempt is ever made to preserve the roads.

The original contract usually goes to some favored politician. The sole scheme being to get all the profit or graft possible, the construction suffers. I know personally of one instance where an engineer insisted that a politician-contractor comply with the conditions of his contract, and was immediately transferred to another part of the State by a complacent State Department.

The quicker this road wears out, the quicker the politician gets another fat job, consequently no repairs are made. Road conservation is therefore a joke. A large part of the taxpayers' $50,000,000 goes to build up local political fences, and faulty roads which two or three years later require at least another $25,000,000 for rebuilding.

It all means prosperity to the politician-contractor.

Brooklyn, N. Y. H. GRATTAN.

[There can be no doubt that our correspondent's contention is correct. Not until road building and road maintenance are placed upon the same sound business basis that underlies every well-conducted industrial enterprise, is it likely that we shall have roads that are good, not simply for this year and perhaps next, but roads that will be good generations hence.—EDITOR.]

"The Digestion of a New-born Infant"

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of June 1st, on page 494, you have a short article under the above heading.

It is no recent discovery that new-born infants are capable of digesting food or that they possess digestive ferments. You mention of Dr. Alfred F. Hess that: "In the stomachs he found not only hydrochloric acid, as in an adult, but the two ferments pepsin and rennet." While it is true that milk requires almost no effort on the part of the digestive system, what little bit it does require is absolutely essential to the process. For instance, in all higher animals the first step in proteid digestion is accomplished by pepsin, a ferment which cannot act except in an acid medium. Hydrochloric being the kind of acid found in the stomachs of carnivora and omnivora. It is usually accompanied by small quantities of lactic acid. Rennin also is found of great importance in the digestion of milk. It is hardly correct to call it rennet, as rennet is a commercial preparation used in the manufacture of cheese, and is obtained from the stomachs of suckling calves and pigs usually.

The other ferments which you mention, namely, protease and lipase, are also necessary. The way in which lipase accomplishes the digestion of the butter fats in the milk is very interesting. To be brief, it splits them up into free fatty acids and glycerin, in which form they are capable of entering the villi. (Innumerable projections from the inner surface of the mucous membrane of the intestines, shaped like minute fingers, they are highly differentiated structures whose chief office is to absorb these digested glycerides.) Once within the villi, the synthesis of fatty acid and glycerin into fat becomes possible. Lipase is greatly aided by the bile in its work of digesting fat.

The hydrochloric acid in the stomach does not have any great effect on bacteria. In fact, none of the digestive juices possess bactericidal properties. Fortunately so, as so very rarely are bacteria harmful; the pathogenic kinds form such a small proportion of the whole.

It might not be out of the way to state that indigestion rarely occurs as a result of an insufficiency of digestive juices, but as a result of too concentrated foods; thus failing to distend the intestines, and so encourage peristalsis. Appropos of this, Dr. Charles E. Buck of Boston says: "This condition never exists in the lower animals, who seldom suffer from intestinal troubles, because the food that they eat contains coarse particles of indigestible residue, that pass along the entire intestinal tract."

Oak Ridge, Va. A. G. INGHAM.

A Notable Lightning Stroke

To the Editor of the SCIENTIFIC AMERICAN:

On the afternoon of July 13th, a discharge of atmospheric electricity occurred in the village of Rockport, Ontario, which presented some features of unusual interest. About 6 P. M. a short and light thunder shower passed over the locality. The lightning seemed to be distant and the thunder was not loud. A single flash, however, struck a large white pine tree some seventy-five feet high, and tore the upper half into pieces, breaking off the branches, stripping the bark, and throwing one large fragment several hundred feet away into the St. Lawrence River.

From the tree the discharge apparently followed the telephone wire into a near-by house, smashing the windows, splintering the woodwork, breaking a 2-inch hole through a wire screen door (the broken wires showing traces of fusion) and, curiously enough, tearing off the metallic casters from a table. The telephone was connected with a ground wire which was attached to a window casing. This wire entirely disappeared, and only a groove in the wood was left.

Two ladies were standing near the telephone, one in the act of using it. Both received a severe shock and were temporarily stunned and benumbed, but recovered in a few hours without apparent injury. Owing to the nature of the soil and the long-continued drought, the ground connection was doubtless imperfect, which led to the damage to the house. Probably, however, it was the imperfect connection which saved the building from more serious injury.

In a building a few rods away a young man was holding a telephone receiver to his ear when the discharge occurred. He was thrown to the ground and received a severe nervous shock from which he did not recover for several days. This building was entirely uninjured, the telephone showed no marks of fire or any other injury, and none of the bystanders felt any shock.

The interesting points about this discharge were the sudden development of a large amount of electrical energy in a very light storm, and the almost total absence of marks of fire on any of the objects or persons struck. The splintering of the enormous pine tree could well be accounted for by the instantaneous development of steam from the sap in the wood, in connection with the expansion of the air in the tissues caused by the sudden heating by the current. The broken glass was thrown outward, indicating an expansion of the air in the rooms of the house.

One of the ladies struck said she felt no pain or shock, and remembered nothing except finding herself on the floor. The young man, however, felt a severe shock at the time, and the current probably passed from the receiver at his ear down the left side of his body, as that side and arm were benumbed for several hours. It was probable that this was an induced current in the telephone wire and not the direct discharge, as this telephone was connected with an entirely different circuit from the one first mentioned.

Rockport, Ontario. AUSTIN P. NICHOLS.

Magnetic and Electrostatic Attraction and Repulsion

To the Editor of the SCIENTIFIC AMERICAN:

I was interested to read in your columns a short letter with reference to the force action between electric charges, and that between magnet poles, but do not exactly agree with the conclusions drawn by the writer, who apparently fails to take into consideration certain phenomena of induced electrification. In a certain sense it is true that under some conditions the question of repulsion or attraction of charged bodies depends upon the magnitudes of their charges, but only in an indirect manner, and the general law of the force action between charges still governs, even in the apparent exception noted.

To make the matter clear we might summarize the law of force action referred to. Briefly it is this: Like charges repel one another and unlike charges attract one another with a force which is directly proportional to the product of the charges *and inversely proportional to the square of the distance between them.* This fact, together with the principles of induced electrification, explains the phenomenon noted by your contributor, namely, that if a body having a sufficiently great charge is brought near enough to another body having a charge of the same sign, attraction will result instead of repulsion, as we should expect.

When a charged body is placed in the neighborhood of another body (whether the latter be charged or uncharged) two induced charges of equal magnitude and of opposite sign are produced upon the latter, the one of like sign being the farther from the inducing charge. Since both charges are of the same magnitude, and the one of unlike sign the nearer, it follows from the law as to distances that the attraction between it and the inducing charge is always necessarily greater than the repulsion between the other charge and the inducing charge. Therefore a body originally uncharged is always attracted. If the body had originally a small charge of the same sign as the inducing charge, the body will be repelled if the distance between it and the induced charge is such that the difference in the distances of the two induced charges is small enough to make the difference between the forces on them less than the repulsion between the inducing charge and the charge originally on the body.

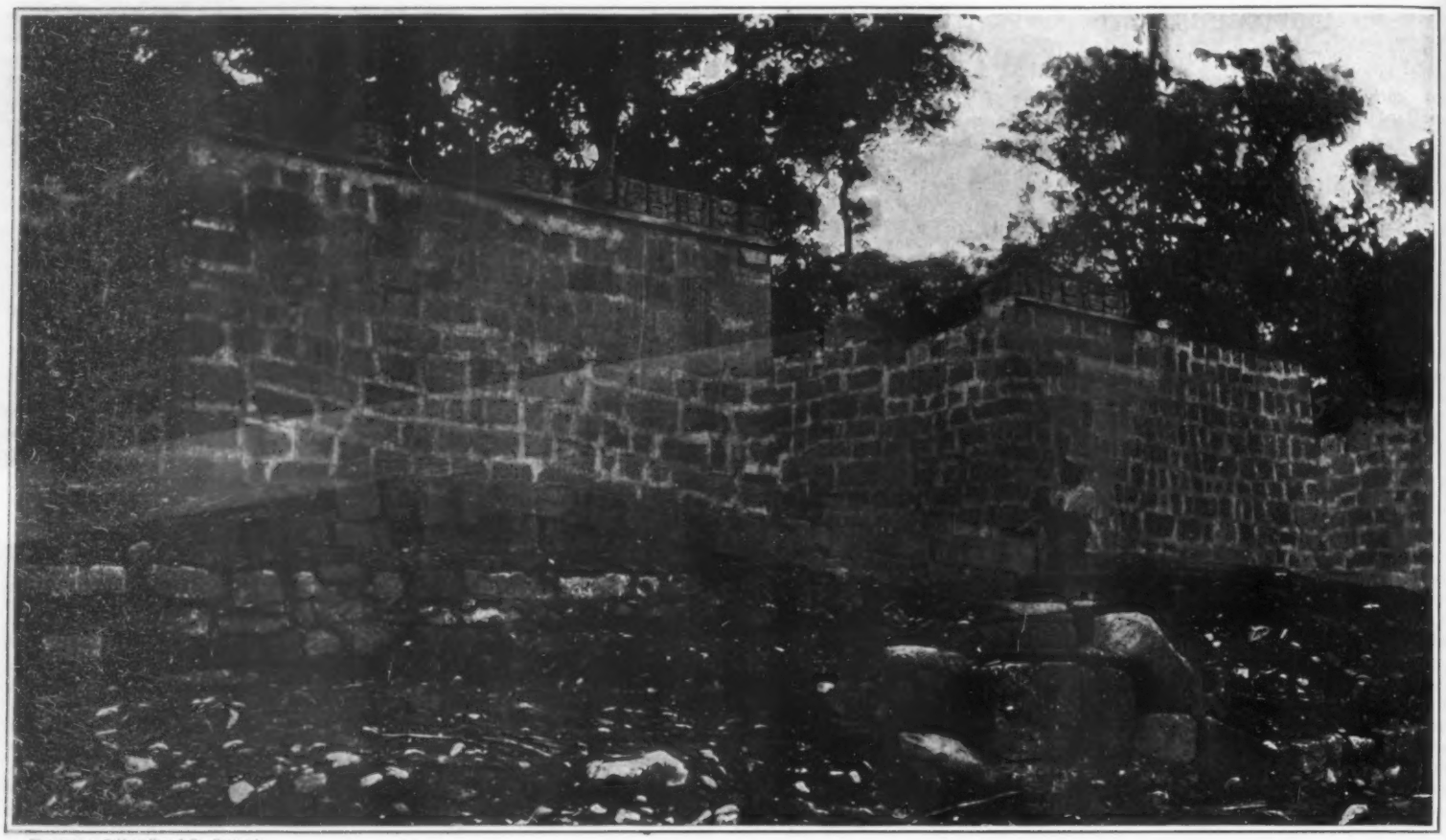
To make the matter concrete, suppose a body with a positive charge of q units placed at a distance of 100 centimeters from a sphere of 5 centimeters diameter, and having a positive charge of 1 unit localized at the end of the diameter nearest the first mentioned body. Suppose, further, that the induced charges are each 5 units similarly localized, one at each end of this diameter, as shown in diagram. Such a distribution is, of course, impossible, but the reasoning will apply equally well to the actual distribution.

We then have force action due to free charge of 1 unit = $1 \times q/10{,}000$. That is repulsion = $q/10{,}000$ dynes. Similarly, the resultant force action (attraction) due to the induced charges is $5q/10{,}000 - 5q/11{,}025$ or about $5q/110{,}000$, approximately one half the repulsion. Therefore, the resultant is a repulsion. If the induced charges were to remain constant (they actually increase) as the charge q is brought up to the neighborhood of the sphere, say 5 centimeters from it, we should have Repulsion = $1 \times q/25$ attraction = $5q/25 - 5q100$. Resultant = $11q/100$ (attraction). This makes it evident that whether a physical object is attracted or repelled by a charged body is a matter of the relative distances of its charges from that body, the law as to the charges themselves still holding.

The conditions are very similar in the case of magnets. When a piece of magnetic material not manifesting poles is brought into the field of a strong magnet it develops poles, that of unlike sign being nearer the magnet pole which induced it. The laws of magnetic force action being precisely similar to those for electrostatic action, the same result follows as to attraction. namely, any unmagnetized bar of magnetic material is attracted. It may be laid down as a pretty safe rule, however, that like magnetic poles never attract one another. The polarity of a weak magnet may, however, often be reversed by bringing it into a strong field so quickly or in such a manner as to prevent its taking the position which the field of the stronger magnet demands. This has been a source of some annoyance in the case of compasses used in the laboratory by students who were careless in this respect.

To sum up definitely, it may be stated that the laws of force action always hold as between charges, or as between magnet poles. Apparent exceptions in the case of charged material bodies are due either to the characteristics of the bodies themselves or to the particular sets of magnetic or electrical constants involved. If not prevented by inertia, friction, or other means from doing so, these bodies behave in accordance with the laws as stated. M. F. THURSTON.

Syracuse, N. Y.



Photograph by Valdesvallano & Co., Guatemala

Fig. 1.—Northeastern corner of Structure 1, showing the hieroglyphic cornice restored to its original position.

Quirigua—An American Town 1,400 Years Old

Glimpses of an Extinct American Civilization

By Sylvanus Griswold Morley, Acting Director Quirigua Expedition, School of American Archæology

We have in the Western Hemisphere archaeological relics of past civilizations as interesting scientifically as the ruins of Egypt, Greece, and Rome. Among them is Quirigua in Guatemala, some fifty miles from the Caribbean Sea. Not until the present year was the systematic exploration of Quirigua begun. This is the first popularly worded article on the results of the excavation that has thus far appeared. The author writes from first-hand knowledge, inasmuch as he was a leading spirit in the work.—EDITOR.

DURING the months of February, March and April, the St. Louis Archæological Society and the United Fruit Company maintained in the field at Quirigua, Guatemala, an archæological expedition, the work being under the direction of the School of American Archæology.

Quirigua was one of the older centers of the great Maya civilization, which flourished in southern Mexico, Guatemala and northern Honduras during the first fifteen centuries of the Christian era. The writer believes that the occupation of this site lasted approximately from 450 to 550 A. D., though Maya students differ considerably on this point.[1]

The work of the two previous seasons of the school at Quirigua, 1910 and 1911, was largely of a preparatory nature. In 1910 the ruins were surveyed and a reservation of 80 acres set aside, which included all the more important remains. The following year (1911) the dense vegetation which had overgrown the city since its abandonment in the sixth century A. D. was cleared away. The importance of this step cannot be overestimated, since the monuments were in constant danger of destruction from falling trees, many of which exceeded 150 feet in height.

The systematic excavation of Quirigua, however, was not commenced until the present year (1912); and it may be said at the outset, that the finds already brought to light amply justify the continuation of the work. The first place selected for excavation was the mound on the south side of the Temple Court. A few preliminary trenches made at this point the year before had established the fact that this mound was the remains of a structure of very considerable importance. Much sculptured stone was strewn around it on all sides; and fragments of a hieroglyphic inscription, including a date, were recovered in the test diggings. This seemed a most promising field for the inauguration of the work, and a start was made here early in February. From surface indications this mound appeared to be 105 feet long and 32 feet wide. It rose from a platform or substructure, the top of which itself was 20 feet above the general ground level.

Before actual digging could commence, it was first necessary to build a trestle to support a tramway by means of which the dirt could be removed. A track was laid along each of the long sides of the building, so that the work of clearing it could proceed from both sides at the same time. As excavation proceeded, the ground plan of this once imposing structure, as well as its nature and use, gradually unfolded themselves.

It was symmetrical in ground plan and contained seven rooms. (See Fig. 6, where a map of this building, Structure 1, is shown.) Entrance to these was gained by three wide doorways—10 feet wide each—in the north façade, which gave into chambers 2, 4 and 6, respectively. The remaining rooms were entered from chambers 2, 4, and 6; chamber 1 from chamber 2; chambers 3 and 5 from chamber 4; and chamber 7 from chamber 6. Three wide exterior doorways appear in Fig. 2, which shows Structure 1 rising from the terrace at the back.

These doorways were of great interest. The wall through which they pass is 8 feet in thickness, and the floors of chambers 2, 4 and 6 were in each case 2 feet higher than the floors of the doorways leading into them. This 2 feet rise was effected by a single step, the front or face of which in each case presented a band of hieroglyphs. (See Fig. 3, where the doorway leading into chamber 4 is shown.) The band of hieroglyphics, against which the pick is leaning, is the top course of this 2-foot step, and, as appears in the figure, projects slightly beyond the courses below it. Chamber 4, but partially excavated, appears in the background. These three wide doorways with their hieroglyphic steps give to this building, even in its desolation, a rare touch of dignity.

The floors of the interior rooms, chambers 1, 3, 5, and 7, are 18 inches above the floors of chambers 2, 4, and 6, from which they are respectively entered.

The rooms of this building average twelve feet in length, and are about half as wide. Although the ceilings have in every case fallen, their original height may be very clearly estimated at about 10 feet. Floors, walls and ceilings were covered with a hard, white lime plaster which still adheres in many places. No traces of wall paintings were found, though their absence may well have been due to the excessive rainfall—over 100 inches annually—to which this region is subjected, rather than to the failure of the ancients to have thus decorated their walls.

Along the back (south) wall of chambers 2, 4 and 6, there were low shelves, about 4 inches wide and a foot in height. (See Fig. 4, where chamber 2 is shown.) Note the shelf running across the back wall. These shelves were covered with the same white lime plaster as the rest of the interiors. In no case was any object found standing on them. In chamber 2, however, the fragments of a fine fluted bowl were found on the floor just against the back wall, and the bowl of which these were the parts probably stood on the shelf above, having been knocked off and broken when the roof fell in. Chambers 1, 3, 4, 6, and 7 yielded absolutely

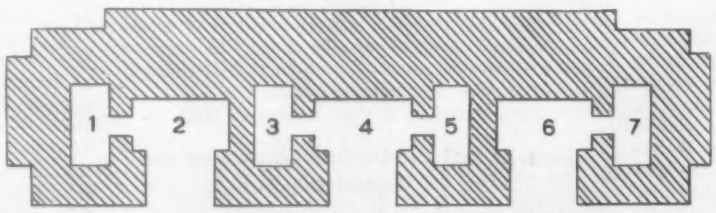


Fig. 6.—Plan of Structure 1 with the chambers numbered.

[1] Various correlations of Maya and Christian chronology have been proposed from time to time, Don Pio Perez, Prof. Eduard Seler, Mr. C. P. Bowditch, and Mr. J. T. Goodman each having advanced a different plan, though most unfortunately no two of these agree. The correlation proposed by the writer, and his reason for adopting it, will be found in "Papers of the School of American Archæology," No. 11. Sylvanus Griswold Morley.

nothing, and chamber 2 only the fluted bowl just mentioned. Indeed, the only room in the entire structure which was at all rich in its yield of specimens was chamber 5, just off of chamber 4. This room contained two very fine flint spear points, as well as a dozen or more pieces of pottery.

In the back wall of chamber 4—the middle room of the building—at a height of 5½ feet above the floor, were tenoned the three stone heads shown in the bottom row of Fig. 5. When the roof of this room fell in, the tenons attaching these heads to the wall were broken, and the heads themselves fell to the floor, where they were uncovered during the excavation of the room. Two similar heads were found on the floor of chamber 6, and the broken butts of the tenons which had held them in the wall were still in position when this room was cleared out.

When Structure 1 was completely excavated it became apparent that it had been a temple rather than a palace or dwelling type of structure. Several different facts pointed to this conclusion In the first place, the location of the building, on a high terrace, which occupied one whole side of the Temple Court, indicated its importance, while the perfect symmetry of its ground plan—an almost universal characteristic of Maya temples[2]—strongly pointed to a building devoted to religious rather than to civil purposes.

Again, the fact that chamber 4, the middle room of the structure, was differentiated by its decoration from the other rooms—i. e., in having three heads tenoned into its back wall—seemed to mark it as the sanctuary proper, while the finding of a dozen or more bowls in an adjoining room, chamber 5, may well be explained on the ground that these vessels had been used in the temple service. The identification of this structure as a temple is further confirmed by certain of its architectural details. The only three entrances by means of which this building can be entered give into the only three rooms which have low shelves running across their back walls. These low shelves are admirably fitted both in character and position for the offering of sacrifices. Indeed, in chambers 4 and 6 it would seem as though the heads which were originally tenoned in their back walls may have represented the very deities to whom the sacrifices were offered. The width of the doorways giving into these three "shelf" or altar rooms is such—i. e., 10 feet—as to make the whole of their front sides open in each case, so that worshipers standing in the broad thresholds could easily see all that went on in the sanctuaries above and before them. The adjoining room or rooms with which each of these three sanctuaries is provided, afforded readily accessible places for the storage of ceremonial objects and religious paraphernalia, as well as convenient rooms in which officiating priests could clothe themselves. On the whole, the religious character of Structure 1 can hardly be doubted.

Before discussing the hieroglyphic inscriptions on the steps in the three abovementioned doorways, it is first necessary to add a word concerning the exterior of this building. In common with almost all Maya structures the façade was divided into two halves by a medial cornice, which ran around the entire building about half way up the façade. In Structure 1 this medial cornice was composed of a band of hieroglyphics. (See Fig. 1, where the northeastern end of Structure 1 is shown with the hieroglyphic cornice restored to its original position.) The inscription began at the northeastern corner of the building, i. e., the corner shown in the above figure, and continued across the front and thence around to the starting point again. This cornice unfortunately was not in place at any point, but the writer was able to restore its first 18 hieroglyphics to their original positions, as appears in Fig. 1.

[2] Throughout the Maya area, symmetry in the ground plans of temple type structures is the almost invariable rule. While it is true that this symmetry of ground plan was very largely extended to dwelling type structures as well, in this latter class, however, asymmetrical ground plans are more frequent than symmetrical. Asymmetry in the ground plan of temple type structures, on the contrary, is exceedingly rare, and consequently symmetry of ground plan is at least a presumptive indication that structures having it were devoted to religious uses.

Photograph by Bucalin, Jr.

Fig. 2.—Structure 1 rising from terrace at the back, with Structure 2 in the foreground at the right.

Photograph by School of American Archæology.

Fig. 3.—Doorway leading into chamber 4, which is partially excavated.

Photograph by School of American Archæology.

Fig. 4.—Chamber 2 completely excavated, showing shelf across the back wall.

Photograph by School of American Archæology.

Fig. 5.—Group of stone heads found during the excavation of Structure 1.

So far as deciphered, this inscription records the date 9.19.0.0.0 9 Ahau 18 Mol of Maya chronology; that is the day 9 Ahau 18 Mol, the closing day of the nineteenth division or katun of cycle 9.

The katun was a Maya time period, which contained 7,200 days, and 20 katuns composed one cycle. We see here then, that when Structure 1 was dedicated, i. e., 9.19.0.0.0 9 Ahau 18 Mol, a cycle was very nearly at its close, since one more katun added to the 19 here recorded made 20 katuns or another cycle. This was indeed the case, for the next katun after the one here recorded ushered in cycle 10 of Maya chronology, i. e., the date 10.0.0.0.0 7 Ahau 18 Zip.

Passing now to a consideration of the texts in the three doorways; it will be found that the inscription in the eastern doorway opens with the date 9 Ahau 18 Xul. No record of the exact position of this date, that is its corresponding cycle or katun, etc., is recorded in this text; and to find its proper place in Maya chronology it is necessary to pass over to the inscription in the middle doorway.

Here there are recorded 40 days, written in Maya notation as two periods of the second order, i. e., as two units, thus 2.0. Following this number occurs the date 9 Ahau 18 Mol, the same as appeared on the outside of the building in the hieroglyphic cornice on which there was declared to be the date, 9.19.0.0.0 9 Ahau 18 Mol of Maya chronology. It is a reasonable assumption, therefore, that the date 9 Ahau 18 Mol in the middle doorway was the same date as the date 9 Ahau 18 Mol outside, or 9.19.0.0.0 9 Ahau 18 Mol. Fortunately, this important point is not left open to conjecture; since in the text in the western doorway the end of katun 19 is explicitly recorded. Moreover, having established the position of this latter date, the date 9 Ahau 18 Xul in the eastern doorway may be reckoned from it, by means of the 40 days which are declared to have elapsed between the two.

The dates on Structure 1, therefore, may be summarized as follows:

Step in Eastern Doorway..(9.18.19.16.0)[3]
9 Ahau 18 Xul.
Step in Middle Doorway.... 2.0 [4]
(9.19.0.0.0)
9 Ahau 18 Mol.
Step in Western Doorway. End of Katun 19
Hieroglyphic Cornice 9.19.0.0.0
9 Ahau 18 Mol.

Although the greater part of this inscription yet remains an enigma, the chronological part as given above, may be accepted as final. Indeed, we may go a step further and analyze this part of the text somewhat as follows: Some important event occurred 40 days before the close of katun 19, at which time, and to commemorate which, Structure 1 was erected. This earlier and less important date was engraved on the step in the eastern doorway, and the distance from it to the really important date concerned here, i. e., 9 Ahau 18 Mol, the close of katun 19, was recorded in the middle doorway. In the middle and western doorways this important date is actually recorded, and it is again repeated in the most conspicuous place about this building, that is in the hieroglyphic cornice which ran around the outside.

The particular significance of this date

(*Continued on page 105.*)

[3] Matter inclosed in parentheses does not appear in the text, but is indicated by the accompanying dates.

[4] In Maya numeration only 18 units of the 2d order are required to make 1 unit of the 3d order. Elsewhere, however, in the 1st, 3d and 4th places, 20 units are required to make 1 unit of the order next higher.

The Heavens in August

Proper Motions and Stars; Changing Constellations; The Planets

By Henry Norris Russell, Ph.D.

As we gaze upon the familiar figures of the constellations, the thought may well impress us deeply that these same groups of stars, practically unaltered in position and brightness, showed themselves to the eyes of the builders of the Pyramids. From the standpoint of recorded history, the starry heavens are the fixed and unvarying canopy which roofs in the changing peoples and empires of earth.

But will this be true if we expand our range of thought to the scale of geological time, or even to that lesser extent which embraces the probable duration of human existence upon our planet? Suppose we might leap in an instant over a hundred thousand years, and look once more at the skies. Would we find then our familiar constellations? Which, if any, among them would still bear a recognizable resemblance to their present aspect?

Bold as the questions may seem to be, modern astronomy is ready with the answer. The positions of the stars have been observed for the past century with high exactness, and their motions calculated with such precision that they may be predicted (in general) for even one hundred thousand years in advance with as great accuracy as they could be plotted by the most careful eye-estimates or laid down on any star-map of ordinary size.

The accompanying illustration shows the results of such a study of the brighter stars of the constellations Scorpius and Sagittarius, which are now so conspicuous in the southern sky. The outline of Scorpius, on the right, and the "Milk Dipper" in Sagittarius on the left, can at once be recognized. The arrow attached to each star shows the direction and amount of its apparent motion in one hundred thousand years.

Before this period is concluded, it is evident that the Milk Dipper will have lost all traces of its present shape, and that the whole constellation of Sagittarius will be quite unrecognizable. This is what we would find in most other constellations.

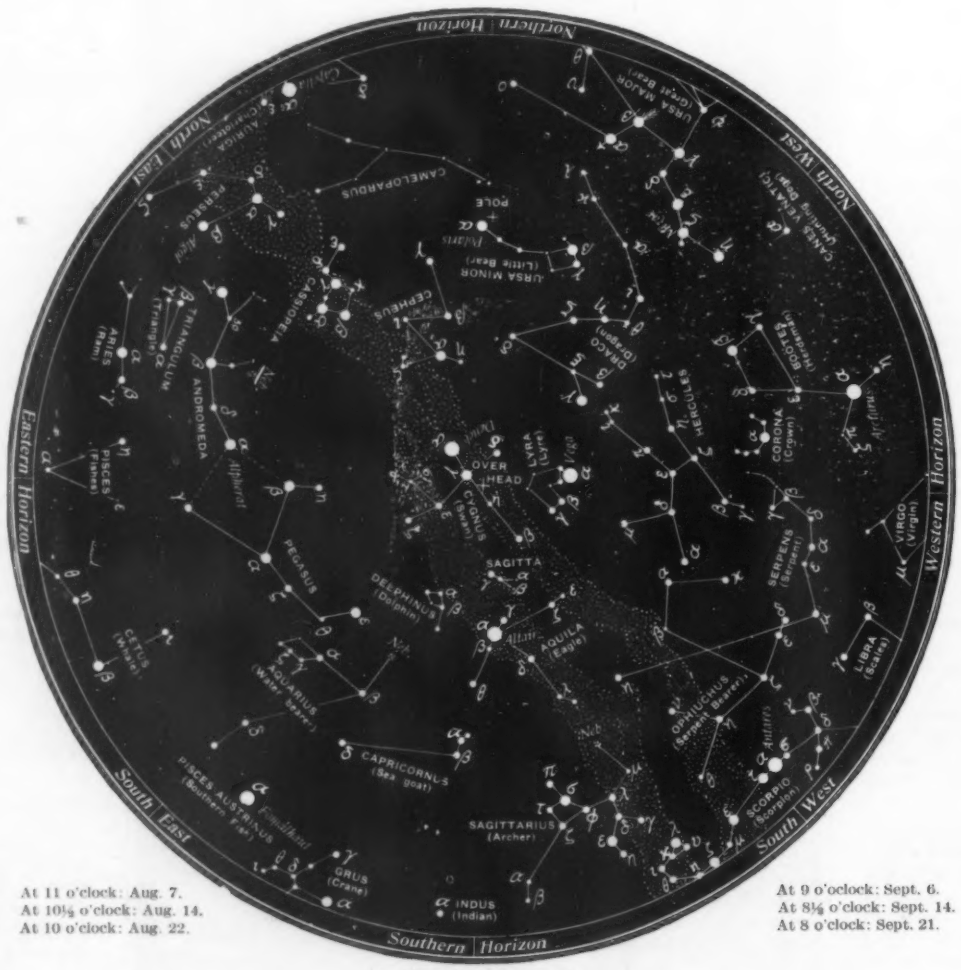
Scorpius affords a very interesting exception to this general rule. A few of its stars—notably Epsilon Scorpii, near the middle of the constellation—are moving at a relatively rapid rate, which will carry them almost out of the region now regarded as belonging to the Scorpion. One or two at the extreme southwestern extremity are moving so slowly that they will be almost in their present places a hundred thousand years hence. But the majority of the stars show a very conspicuous tendency to *keep* together in their motion. The eight bright stars in the upper part (including Antares) will be in almost exactly the same relative configuration then as now, though about a degree farther south. Both components of the naked-eye double μ (shown as a single star on the diagram, next below the rapidly moving ϵ) and the conspicuous stars λ and υ at the tip of the tail, evidently share in the motion of this group, as does Theta Ophiuchi, farther to the north, and also a number of fainter stars, not shown in our figure.

So many of the stars of the constellation are involved in this common "drift," that the figure of the Scorpion will still be recognizable, even after the other stars which are at present counted as belonging to it have moved clear away into other constellations; and the "head" at least should be recognizable even half a million years hence. Hardly any other constellation will last as long, excepting Orion, all whose principal stars are moving even more slowly than those of Scorpius.

Such a remarkable community of motion among the stars of a well-defined region cannot possibly be the result of chance. It requires only a glance at the diagram to convince anyone that they form a real cluster, are relatively near one another (compared with their distance from us), and are moving together in the same direction. This is in fact the most conspicuous example in the heavens of the "moving clusters" of stars, of which so much has recently been heard in the astronomical world, and its nature has been pointed out independently by several astronomers—Prof. Kapteyn, Mr. Eddington of Greenwich, and Mr. Benjamin Boss of Albany. This is not all. It is perceptible, even on the diagram, and evident from an exact study of the stars' motions, that the easternmost stars of the cluster appear to move in a direction decidedly to the east of south, while the westernmost are going almost due south. The obvious explanation is that the cluster is approaching us, and hence appearing to grow larger and spread out. This is confirmed by the spectroscopic measurements of the radial velocity of many of these stars, which (after applying certain corrections, the need for which has been shown by Prof. Campbell) show that they are all approaching one system slowly, at an average rate of about four miles per second.

This, as well as the other facts regarding this cluster, can be explained on the assumption that the stars composing it are practically at rest in space, and that their apparent motions are really due to the sun's motion. This makes it possible to calculate the distance of the group, which comes out rather more than three hundred light-years. At this distance the sun would be utterly invisible to the naked eye—fainter, in fact, than the ninth magnitude. The conspicuous stars of the cluster must, therefore, be of great brightness. All those shown on the diagram exceed two hundred times the brightness of the sun, while most of them must give out fully five hundred times, and Antares not less than two thousand times, as much light as the ruler of our system.

Proper motions of stars in Scorpius and Sagittarius in one hundred thousand years.



At 11 o'clock: Aug. 7.
At 10½ o'clock: Aug. 14.
At 10 o'clock: Aug. 22.

At 9 o'clock: Sept. 6.
At 8½ o'clock: Sept. 14.
At 8 o'clock: Sept. 21.

At 9½ o'clock: August 29.

NIGHT SKY: AUGUST AND SEPTEMBER

The Heavens.

Our map shows the aspect of the evening sky, and requires little explanation. Scorpius and Sagittarius, of which we have been speaking, are conspicuous in the south and southwest. Above them is Ophiuchus, then Aquila, with Cygnus and Lyra overhead. Hercules, Corona, and Boötes are in the west, Draco and Ursa Major in the northwest, and Perseus and Cassiopeia in the northeast. Aries, Pisces, and a part of Cetus are on the eastern horizon, with Andromeda and Pegasus above them. Aquarius, Capricornus, and the Southern Fish in the southeast complete our survey.

The Planets.

Mercury is evening star until the 22d, and morning star after that date, but is not very well placed for observation even at the beginning of the month. At this time he sets a little after 8 P. M. and may be seen in the twilight, but by the 10th he gets too close to the sun, and too far south, to be easily seen, and remains invisible through the month.

Venus is theoretically an evening star once more, and may perhaps be seen in the latter part of the month (though she sets but a little after 7 P. M.) because of her great brightness.

Mars is still an evening star, in Leo, setting about 8 P. M. in the middle of the month, and too low in the west at dark to be easily seen.

Jupiter is in Scorpio, and comes into quadrature with the sun on the 30th. He is a splendid object in the evening sky, but sets before midnight. Saturn is on the opposite side of the heavens, in Taurus. He is in quadrature on the 27th, and rises a little before 11 P. M.

Uranus is in Capricornus, and crosses the meridian about 10 P. M. in the middle of the month. He may readily be found with the aid of the maps published in previous issues.

Neptune is in Gemini, rising about 1 A. M.

The moon is in her last quarter at 10 P. M. on August 5th, new at 2 P. M. on the 12th, in her first quarter at 11 A. M. on the 19th, and full at 2 P. M. on the 27th. She is nearest the earth on the 12th (high tides again expected) and farthest away on the 25th.

She is in conjunction with Jupiter on the 7th, Neptune on the 10th, Venus and Mercury on the 13th, Mars on the 14th, Jupiter on the 20th, and Uranus on the 24th; none of the observable approaches being close.

Princeton Observatory.

The Business Aspect of Synthetic Rubber

What are the Prospects of the New Discovery?

By Prof. Dr. F. W. Hinrichsen, of the Koenigliches Material-Pruefungsamt

The author of this article recently completed for the Koenigliches Material-Pruefungsamt at Lichterfelde a very elaborate investigation of rubber. No man is better qualified than he to discuss the technical and commercial significance of the discovery of synthetic rubber made by Prof. Perkin. While the Editor does not wish either to detract from Prof. Hinrichsen's argument or to assist the stock-selling transactions of the English company formed to exploit the new discovery, it seems only fair to point out that in the prospectus of the English company it is clearly set forth that the immediate purpose is to manufacture fusel oil and acetone, and that part of the proceeds assured in this way are to be devoted to research on a factory scale upon the new rubber process.—EDITOR.

AT the great jubilee meeting of the Society of German Chemists, which took place at Freiburg im Breisgau last Whitsuntide, the attention of the general public was drawn to the question of the synthetic production of India rubber, two workers of special prominence in this field, Prof. C. Harries, of Kiel, and Dr. F. Hofmann, of Elberfeld, giving a comprehensive report, from the scientific and technical standpoint, on the present status of the problem.

Only recently Prof. Perkin, in England, has read a paper on the same subject, and has given publicity to new results of research in this field. While, however, the two German investigators mentioned above were very guarded and skeptical in their expressions relating to the future of synthetic caoutchouc, and regarded the time when synthetic rubber will appear upon the market as still far off, the lecture of the English chemist was more optimistic. The result was that a company with $2,500,000 was immediately founded, which counts among its board of directors no less a chemical authority than Sir William Ramsay, while Sir William Tilden has been retained as consulting chemist. Nevertheless, the opening of the list for subscriptions for shares, so far as we can judge from report, seems to have been a comparative failure, only a very small amount of capital having been sunk in the new foundation. The conservatism displayed in this case by the English public would seem to be entirely justified, for, upon critical examination, it is found that even the new results communicated by Prof. Perkin do not by any means justify the hope that any considerable quantities of synthetic caoutchouc will be produced in the near future.

From the scientific standpoint, the question of caoutchouc synthesis is clear at the present time. It is well known that caoutchouc is formed from isoprene, a compound of carbon and hydrogen, obtained as a mobile, colorless liquid of low boiling point (35 deg. Cent.), for example on heating caoutchouc itself or turpentine. As was first shown by Hofmann, rubber-like bodies are also obtainable from other compounds of carbon and hydrogen besides isoprene, which, however, must have a somewhat similar chemical constitution. Among them may be mentioned the hydrocarbon butadiene. The transformation of such compounds into caoutchouc can be effected either by simply heating under pressure with or without the addition of other substances (Hofmann) or by the influence of small quantities of metallic sodium (Harries); the products obtained differ entirely in their properties, according to the nature of the initial material employed and the conditions of transformation.

In order that synthetic rubber may be capable of competing successfully with the natural product, it must be equal to it in technical use and must be at least as cheap to manufacture.

As regards the first question, there can hardly be any doubt that in the course of time it will be possible to produce rubber by artificial means which will be equal or even superior to natural rubber in technical use. We have not, however, as yet arrived at this stage.

The price of synthetic rubber, on the other hand, depends, in the first place, on the cost of production of the initial material, isoprene, and allied hydrocarbons. Here also it can hardly be doubted that before very long processes will be found which will yield these substances more cheaply than methods known hitherto. At the present time, however, there is no such method known for isoprene, the parent substance of natural rubber. The problem is rendered particularly difficult through the fact that the substances employed must be specially pure. Most of the processes proposed hitherto do not yield a pure isoprene, but mixtures of different hydrocarbons of similar constitution. Hofmann himself, in the preparation of pure isoprene, starts from a constituent of coal tar, namely, cresol; but in this process also, so far as can be judged at the present, the cost of production is considerably greater than for natural rubber.

But even if it should be possible to prepare sufficient quantities of isoprene at a sufficiently low cost, the difficulties of the problem, as Hofmann has pointed out, only begin, for the yields are comparatively small in all methods of this kind. Consequently, in technical production on a large scale, such as is implied in case serious competition with the natural product should be contemplated, such enormous quantities of by-products are obtained, that their disposal or utilization would probably present a more difficult problem from the economical and technical point of view than manufacture of the caoutchouc itself. How is it in this regard with the new process communicated by Prof. Hofmann, and so hastily made the basis of financial operations? The principle of the new method of producing synthetic caoutchouc depends, on the one hand, on the cheap production of hydrocarbons which can be used as initial materials for rubber; on the other hand, on the acceleration of the conversion of these hydrocarbons into rubber-like substances. Prof. Fernbach, of the Pasteur Institute in Paris, has shown that starch (obtained from potatoes or maize) can be converted by means of yeast-like ferments into a mixture of fusel oil and acetone. From these compounds, the hydrocarbons required as raw material for the caoutchouc can be produced by suitable chemical transformation. The transformation of these substances into rubber-like bodies is effected by means of metallic sodium; that is to say, by the same means as discovered and used independently by Harries. According to Perkin's communication, this method was discovered and made the subject of patent application by Matthews half a year before Harries, though no publication was made of the fact. It must, therefore, be admitted that the priority of invention belongs to Matthews.

The use of starch as the initial material is alluring at first sight, owing to its low price. When, however, we examine the new process a little more closely, we cannot quite suppress doubts as to its financial soundness. An inquiry addressed to the highly reputed *India Rubber Journal* of London, regarding yields obtained in the several stages of the process, brought the following information. By Fernbach's process there is obtained from starch 42 per cent to 43 per cent crude fusel oil. The starch content of potatoes or maize is about 60 per cent. The "fusel oil" itself is said to contain only about two-thirds of true fusel oil, the rest being acetone and other compounds. Furthermore, the fusel oil gives a yield of 40 per cent to 50 per cent of isoprene, which latter is converted without loss into rubber. According to calculations which the above-mentioned English technical journal made, 100 tons of starch will be required for the production of 1 ton of synthetic caoutchouc in this way. From this it follows that only about 1 per cent yield, figured on the starch, is finally obtained, while 99 per cent of the latter goes into by-products. For the production of a quantity of synthetic rubber corresponding to the present world's consumption (about 74,000 tons), such an immense surface would have to be planted with potatoes that the ground now occupied by rubber plantations would represent only a small fraction of this.

That such a process as this cannot be very practicable is obvious. Added to this is the fact that the proof is still owing that the material obtained by the English process fulfills the technical conditions.

As has been shown by Harries, artificial rubbers obtained by means of metallic sodium differ chemically from natural rubber. It is, therefore, not by any means probable, *à priori*, that the new products will be found equal in their mechanical and physical properties to natural rubber. The situation is rendered still more difficult through the fact that the chief constituent of the product obtained by Fernbach's process is so-called butyl alcohol, which, on further treatment, does not yield isoprene, the parent substance of natural caoutchouc, but butadiene, which has already been referred to. We may, therefore, expect that the English process will yield substances differing materially in their properties from natural rubber. In any case, their technical usefulness and value is still awaiting proof. On this point there is practically no evidence available. The invention is still in the laboratory stage. As we read in the *India Rubber Journal*, there have hitherto not been prepared more than one or two pounds of synthetic rubber by the newly described process.

There is, therefore, no doubt that the formation of the company is premature. Synthetic rubber will certainly come, and will claim its place upon the world's market, not suddenly, however, at one blow, but gradually. Even then it is not probable that it will ever completely displace the natural product, especially the plantation rubber. It is much more likely that some sort of equilibrium will be struck, similar to that which now exists with regard to artificial and natural silk. In the field of technical progress, the law of inertia rules as in other domains.

The Increasing Temperature of the World

A PROPHECY of what is claimed by many to be the increasing temperature of the earth and an explanation of the recent prevalence of hot summers is found in a volume written by C. R. Van Hise, president of the University of Wisconsin, and published in 1904 by the United States Geological Survey. In this book (A Treatise on Metamorphism) Prof. Van Hise pointed out that the enormous burning of coal by man must steadily vitiate the air by the discharge of carbon dioxide, and that this vitiation must bring about a marked increase in the temperature of the globe. He says (pages 463-465):

In 1899 the amount of coal mined and oxidized amounted to 723,287,454 metric tons. At the beginning of the last decade of the nineteenth century, 1890, the production was only 511,518,358 metric tons. This shows how rapid the increase in the use of coal has been, and therefore a combustion of 1,000,000,000 metric tons a year is probably very conservative as the estimated average for the present century. Taking 1,000,000,000 metric tons as the amount of coal oxidized per annum for the future, and supposing the amount of carbon in this coal to average 80 per cent, the quantity of carbon which passes into the atmosphere would be 2,933,333,000 metric tons per annum. This is 0.1233 per cent of the total amount of carbon at present in the atmosphere. If this rate of consumption of coal were continued 812 years the amount of carbon in the atmosphere would be doubled.

"It therefore appears probable that within a comparatively short time in the future, as compared with a single geological period, or even an epoch, the amount of carbon in one of its great reservoirs, the atmosphere, will be increased to an important extent. From this fact, various geological consequences are likely to follow. One of the most important of these is a higher average temperature for the globe. According to Arrhenius, if the carbon dioxide is increased 2.5 to 3 times its present value, the temperature in the Arctic regions must rise 8 deg. to 9 deg. Cent. (14 deg. to 15 deg. Fahr.) and produce a climate as mild as that of the Eocene period. According to the above computation, the carbon would be increased by the oxidation of coal alone to three times its present amount in one thousand six hundred and twenty-four years.

"A further consequence which would follow from an increase in the amount of carbon in the atmosphere and the warmer climate would be a much more abundant and widespread vegetation, and more vegetation means that when oxidized more carbon dioxide will be concentrated in the soil, and this concentration will lead to an acceleration in the rate of carbonation. Furthermore, the increase in average temperature of the globe will accelerate all other chemical reactions of the belt of weathering. It therefore appears probable that the artificial oxidation of coal will result in some of the most profound and far-reaching geological consequences which are due to the agency of man."

Since this was written the world's annual consumption of coal has about doubled, so that six thousand million tons of carbonic oxide are now being annually discharged into the atmosphere. In view of this fact, there is little wonder that Prof. Van Hise's prognostications in regard to the increased temperature should have been so swiftly verified.

Curiosities of Science and Invention

A Land and Water Cycle

A RESIDENT of Oakland, California, owns a contrivance of his own making which it is claimed will convey him over land at a rate of twenty miles per hour and on water at the rate of fifteen miles an hour. The device he calls a hydro-motorcycle. It consists of a motorcycle equipped with two canoe-shaped metal floats, each fourteen feet long and about sixteen inches wide. Each canoe is divided into three airtight compartments and is fastened on a light steel tube frame. When traveling over land, the floats are evenly balanced, as they are carried one on each side of the motorcycle. When it is desired to make a water craft of the motorcycle, the two floats are simply reversed on their hinges and clamped down by a simple device. The propeller which, when not in use, is carried behind the seat may be dropped down into the water to propel the craft. The propeller drive contains a clutch which connects the power with a 3-foot propeller shaft of ¾-inch steel. The propeller has three 12-inch blades. Steering is effected by means of two small rudders, one on each of the floats, and both connected to the handlebar of the motorcycle. The total weight of this amphibious vehicle is 425 pounds, of which 225 pounds represents the weight of the attachment.

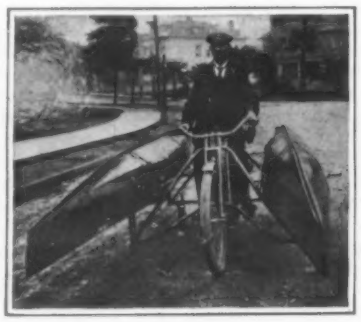
Amateur's Star Finder

AN astronomical instrument of great precision and remarkable simplicity, enabling any layman to ascertain the names of stars of constellations observed in the skies, and inversely find any star whose name or position has been given, has been designed by F. Sartorius of Göttingen. The star finder consists of a star map which may be adjusted to the geographical latitude of the place, and, a diopter pointed toward the star to be determined. Actually the device consists of an equatorial mounting, similar to that of a telescope. The main stand is a tripod provided with a spirit level for adjusting the head to horizontal position. The stand carries a graduated arc for setting the axis of the star map to the proper angle of inclination. It will be understood, of course, that the axis must be parallel to that of the earth, so that it will point to the North Pole of the heavens. The angle of inclination, therefore, is that of the latitude of the place. For instance, the latitude of New York is about 41 degrees north, consequently the axis would have to incline 41 degrees from the horizontal. A compass is provided for setting the axis in the north and south plane. The star map, then, will lie in the plane of the celestial equator. Mounted to rotate over the surface of the star map are two arms which cross each other at right angles. At the end of one of these arms the diopter is mounted, so that it may be rotated in a plane at right angles to that of the equator. The star map is provided along the circumference with graduations which indicate the right ascension of a star, also with a scale which shows the daily and monthly displacement of the heavens to be accounted for. In using the apparatus the hourly advance should also be followed continually. The diopter is swung bodily about the star map, until the arm that lies at right angles to its axis comes in contact with the star on the map whose position in the heavens it is desired to find. Then the diopter is swung to the proper angle of declination of the star as indicated by the graduations on the arm, when, on looking through the diopter, the star will fall within the field of observation. This instrument will doubtless be welcomed as an excellent means of getting an insight.

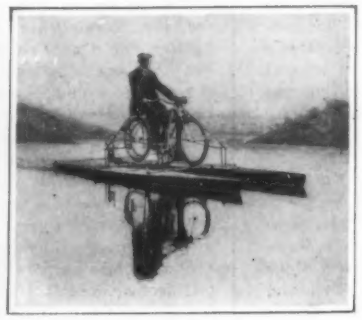
Who Owns Spitzbergen?

THIS question is often asked nowadays, in view of the remarkable development of these Arctic islands. A conference to settle the question has just been held between the governments of Russia, Sweden and Norway. A convention has been drawn up, in accordance with which Spitzbergen will be a neutral territory, open to all nations, but governed by a joint board consisting of one representative of each of the three powers above named. Taxes will be levied by the board, subject to the approval of the respective governments.

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.



The floats folded up for land travel.

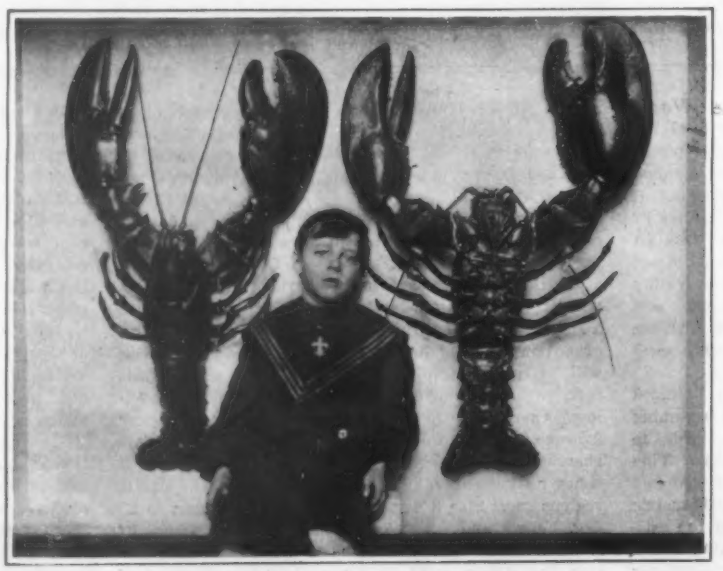


A spin on the water.

An instrument for locating and identifying stars.

Apparatus for scaring sheep together and wolves away.

Wild boar group in the American Museum of Natural History.



Sixty-two pound lobster catch off the Highlands of New Jersey.

A Sheep Protector

AN invention to protect sheep from the inroads of wolves, coyotes and other animals that prey upon the herds has been devised by E. C. Winchester of Thermopolis, Wyoming, and has been pronounced by sheep men of that region to be the most practical device for scaring away wild animals and keeping the sheep together at night that has yet been offered. The machine consists of an automatic gun which will shoot a blank cartridge every 30, 40 or 60 minutes, as arranged, while a bull's eye lantern is so adjusted as to revolve and flash its light in every direction. It makes more than one revolution a minute, operating by means of a coiled spring and cogwheels, a sort of clockwork, in fact. The mechanism is inclosed in a storm and dustproof metal case and mounted on four adjustable legs. It has a weight of 25 pounds, so that it can be carried with the sheepman's outfit with no difficulty.

Wild Boar Group in Realistic Surroundings

A NOTEWORTHY wild boar group, the first of its kind to be seen in this country, has recently been placed on exhibition at the Museum of Natural History, New York. A colony of nine animals, old and young, have been realistically grouped so as to represent a habitat scene in winter in the forests of Germany, with a painted background of mountains. The group measures 9 by 15 feet. The series of fine boar skins was presented to the museum by Mr. Walter Winans, who is a noted sportsman, hunter, and horseman. The right foreground is occupied by two of the largest male boars, depicted in a fierce battle, a number of young ones are seen lying on the ground, while other still larger ones are standing in the near distance, watching the outcome of the combat. The spirited and lifelike modeling of the animals and the mounting was executed by Mr. Frederick Blaschke, the animal sculptor of the museum. The group is considered to be one of the finest and most up-to-date examples of the new plastic taxidermy.

Two Record-holding Lobsters

TWO lobsters that are claimed to hold the world's record for size have just been mounted and placed on exhibition in the Museum of Natural History, New York. The larger specimen, the one on the right, weighed, when alive, 34 pounds and was nearly three feet long; the other one weighed 28 pounds. Both of these monster lobsters were caught off the Highlands of New Jersey, where they are said to have played havoc with the lobster traps, cutting holes in them and robbing them of all the bait, as their bodies were too large to get inside. Finally they were hauled up to the surface clinging to a trap. The larger specimen showed many scars, evidently from savage combats. The length of its life is estimated to have been fifty years as the average age of a ten or twelve-inch lobster is thirty years. The sea is a very poor nursery, and the best authorities figure the rate of survival in the lobster as about 2 in 30,000 eggs. Owing to over-fishing and illegal destruction of the egg-bearing females, etc., large lobsters are fast disappearing. Out of a catch of 1,000 in a recent Government experiment in New England, only 25 were found to be 13 and 14 inches long. Their ultimate extinction in the near future, it is thought by fishery experts, can be prevented, only by artificial propagation, which has been so successfully demonstrated at the Rhode Island hatchery at Wickford.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Gaging the Cultivated Blueberry

WHILE the New England blueberry is justly famous, its systematic cultivation, until recently, has been neglected, largely through the belief that it was impossible.

The large bushes in the grounds of the Smithsonian Institution at Washington are probably more than fifty years old, and many such bushes in the Arnold Arboretum near Boston demonstrate the fallacy of the idea that the blueberry cannot be transplanted and cultivated.

Some years ago Dr. Frederick D. Coville, botanist in charge of Taxonomic and Range Investigations of the Department of Agriculture, started upon a series of investigations of the culture of the berries, which has continued to the present time with somewhat remarkable results. Proceeding with the idea that previous failures along the same line had been due to a misunderstanding of the soil requirements of the blueberry, which are radically different from those of our common cultivated plants, the Doctor, whose interest in the subject was attracted as far back as 1906, has made a careful study of the soil requirements with important results. It is evident from a consideration of what he has accomplished, as fully set out in a bulletin of the Bureau of Plant Industry of the Department of Agriculture, that the problem has been practically solved. As each advance in the arts and sciences creates a new condition or conditions, and these make demands upon the creative faculties, the Doctor found it necessary to devise a gage. This huckleberryometer, or blueberry gage, as it is more prosaically known in the department, is used for measuring the berries and in noting the progress of the cultivation. The possibility of culture has not only been demonstrated but the size development as well. Starting with a normal size of the opening No. 11 of the gage, the berries have been developed to size No. 15 and doubtless a further cultivation will result in a much larger size, the flavor and fruitiness of the berry being improved, rather than impaired, by the cultivation.

Some Interesting Toys

TOYS, especially toys in the form of dolls, are interesting to most people, and we sometimes find a toy that combines the utilitarian with the amusing. Thus Mary L. Rusk of New York city has patented a water bottle, No. 1,026,460, in which is combined a hot water bag and a cover in the form of a doll, the dress of the doll extending over the hot water bottle. By this construction, as the patentee expresses it, there is provided a hot fluid container which by reason of its appearance will be attractive to a child so that a child will permit it to be placed near it. Thus the child in taking the doll to bed with it will also have a bed warmer at the same time.

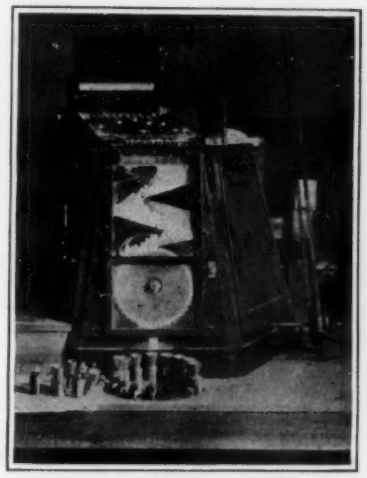
J. G. Hamley of London, England, has patented, No. 1,028,068, a toy which is shown in the resemblance of an ape and it is formed of a bag of felt, cloth or other suitable material and the lips or jaws are flexible, so that they may be manipulated by the hand to produce a grotesque and realistic effect.

Another toy has been patented, No. 1,025,969, to F. W. Flegel. It includes a stationary picture card which has an opening in it and within the opening is arranged a contortive diaphragm which may be of sheet rubber and contains a portion of a figure such as the back and shoulders of a man, while the complementary arm portions of the figure are upon the stationary card, so that the contortive portion in the opening of the fixed card can be manipulated to produce an effect similar to that of working the muscles of the back.

A Tablet Sorting, Counting and Filling Machine

By the English Correspondent of the Scientific American

THE increasing popularity of medicinal preparations in a compressed tablet form has resulted in the evolution of an ingenious apparatus for sorting, counting and packing these preparations, which is shown in the accompanying illustration. The machine is the invention of Mr. Eduard Naumann, of Göthen, Anhalt, Germany, and has been in operation in one of the largest Berlin manufactories for several months past with complete success. The tablets are poured into a trough-like hopper, which is fitted with a specially constructed roller for the purpose of cutting off the supply and which permits a certain number of the pellets to be carried on to an agitator which sifts off the adhesive powder. The tablets are then carried forward automatically on to a grid where the imperfect tabloids are rejected.



Medical tablet sorting, sifting, counting and filling machine.

The pellets are now moved forward to the counting mechanism where, by means of a peculiar movement, the required number to enter the bottle or box are counted off and emptied into the receptacle. The counting device can be altered so that any number of pellets as desired may be passed into the vessel. A short pause is then made to allow the charged bottle to be removed, and an empty receptacle substituted at the mouth of the machine.

The apparatus can be worked either by motor power or by hand. It has been found to be thoroughly reliable, exact, and efficient. In a working day of seven hours some 200,000 tablets can be sorted, sifted, counted, and charged into boxes or bottles.

Firing Submarine Mines by Wireless Telegraphy

DR. BRANLY, the well-known French scientist, has been engaged for some time past upon various kinds of wireless distant control apparatus. He has already devised some very successful instruments for steering torpedoes, firing submarine mines, lighting lamps and carrying out a large number of operations from a distant post by sending out suitable wave signals as in wireless telegraphy. More recently he has brought out the apparatus which we illustrate here, and it is intended to protect the distant control devices against the action of continuous streams of sparks such as the enemy might send out in time of war. Not only does it prevent the continuous sparks from having any action upon the apparatus, in the case of firing a submarine mine, for instance, but should the sparks cease even for a short time, the home operator can now send out a special signal which will fire the mine. The enemy, on the other hand, will be powerless to carry out any operation of the kind. Dr. Branly's protecting device consists of a horizontal disk moved by clockwork and is kept constantly in rotation, first to the right and then to the left, by means of electro-magnets which are acted upon by distant waves. The rotation of the disk causes a series of electric contacts. The whole is so combined that when continuous sparks are sent out, the disk does nothing but rotate forward and back under this action. Should these disturbing sparks cease, the operator has time to send out certain spark signals, which act upon the disk and its electric contacts in such a way that the mine is fired. These signals are combined in such way that they are known only to the operator. In the present apparatus, the waves are received by a new type of coherer illustrated in Fig. 1. It is a modified form of Dr. Branly's tripod coherer, and is made up of a polished steel cylinder, *A*, at the lower part. It is fitted on an upright support and from this three arms, *B*, hang down by means of pivots. The arms carry well rounded steel projections which bear lightly upon the cylinder so as to make the coherer contact. One wire, *C*, comes in at the top and the second wire, *D*, is connected to the steel cylinder through the base, *M*. The whole is inclosed in a vacuum chamber in order to protect the coherer from the action of the air, and by passing electric sparks in the upper part of the chamber it can be seen whether the vacuum is in good condition. Fig. 2 shows an automatic device for replacing the operator in order to send out signals for firing the mine at stated intervals. A cam works upon a rotating disk for this purpose, and the signals can be varied by changing the notches upon the disk.

Fig. 1.—Receiving instrument.

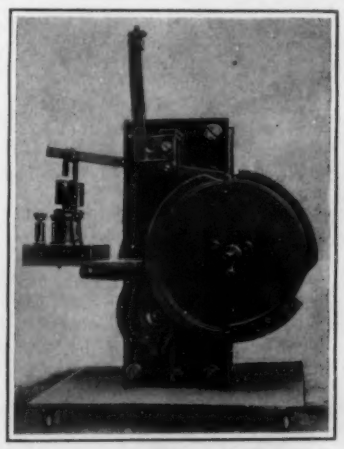


Fig. 2.—Apparatus for firing the mines at stated intervals.

A Typewriter Which Corrects and Manifolds

MANY suggestions for improving the typewriter have been made, but nobody seems to have gone so far as to expect a typewriter to correct any defective manuscript, producing a faultless document without any trace of correction in any number of copies. This is, however, what a German inventor, Mr. Oswald Poppe, of Gera, has achieved. His invention has been patented and a working model constructed.

The apparatus forms the table of an ordinary typewriter with which it may be so connected as to allow of its being dismounted at any moment. Whenever the typewriter has produced a defective manuscript the new apparatus is called upon to correct it. If any word or clause is to be eliminated, a special key is struck at the points corresponding with the beginning and end respectively of these passages. If, on the other hand, any groups of words are to be inserted a similar key is struck at the point of the manuscript where the insertion is to be made. The words to be inserted are then written at the end of the manuscript or on a paper tape placed underneath, a correcting key being again pressed down before as well as behind these words. The defective and corrected manuscript having then been removed, a new sheet of paper is put on the roll, after which a spring is wound up or some other motive force applied. The typewriter now prepares automatically a new faultless manuscript at high speed where there are no gaps, the lines being divided automatically at the end of syllables. The typewriter can thus be allowed to continue its work, producing any number of identical manuscripts, and inscribing, if required, automatically, a different address on every copy. The manuscripts thus obtained are not distinguished in any way from hand-type documents. The output of the machine can, of course, be multiplied by producing carbon copies.

The apparatus achieves this result by producing simultaneously with the manuscript a small pattern of plain paper which is about the same size. Each letter is marked in this pattern by two or three neat holes arranged in lines, which allow the letter to be reproduced on the keyboard. Leaves of patterns can be filed for reference or later reproduction.

The same principle can, of course, be applied to type-setting machines.

A Money-washing Machine

THE United States Government recently installed in the Treasury Department for experimental purposes, the machine for renovating bank notes and other bills recently described in these columns. The machine is about fifteen feet long and includes flexible belts moving face to face and properly manipulated to secure a scrubbing action upon the bills. The bills travel a distance of from 60 to 70 feet in passing through the machine and in such course pass through a washing solution, a germicide mixture and a starching or stiffening preparation, and are finally ironed and discharged in appearance and crispness practically new bills. The cost of producing a thousand bills is nearly fifteen dollars, while it is estimated that the cost of renovating bills by the machine in the manner described will not exceed in the neighborhood of fifty cents per thousand.

The Trade-mark as a Business Asset

By W. E. Woodward

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[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the fourth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Analysis of the Requirements for Registration.—IV.

(*Continued from page 88, July 27th, 1912.*)

Great care should be taken by an applicant for registration of a trade-mark, or his attorney, to avoid conflict with a trade-mark that is already registered or already in use (even if not registered) provided that it is applied to the same class of merchandise as that of the applicant. Lack of caution in this respect has caused interminable annoyance and litigation, with consequent financial loss.

In considering the question of conflicting marks, the Patent Office and the Federal courts hold that the test of similarity is whether the marks are sufficiently alike in appearance or wording, or sound, to mislead the average individual. The word "Autola," as a trade-mark for cigars, was held not registrable, owing to a prior registration of the word "Auto-do" for the same class of merchandise. In this instance, registration was refused on the basis of resemblance in sound as well as in appearance. "Lady Lee" having been registered as a trade-mark for shoes, "Lady Like" was refused registration in the same class. "Certosa," as a mark for a brand of flour, sufficiently resembled "Ceresota"—already registered—to cause its rejection. "Powellton" failed registration as a trade-mark for coal, on the ground that another company's coal already bore the registered mark "Powell's Run." "Sodafoam" was considered close enough in resemblance to "Sea Foam" (already registered in the same class) to cause its rejection. "Uno," having been registered as a trade-mark for a medicine, an application for the registration of "Ino" in the same class was refused.

Registration is refused a trade-mark when it consists of words describing a symbolic or pictorial device which has already been registered; or *vice versa*, when the wording has been registered first, registration for the symbol is refused. For instance, the Patent Office has held that a trade-mark consisting of a conventional representation of a bouquet of flowers is identical in meaning with another mark consisting of the word "Bouquet," applied to the same class of merchandise. In either case, the goods would be called "Bouquet Brand."

Agreement among owners of conflicting marks is not recognized by the Patent Office. An interesting example of this occurred in the attempt to register the word "Nayassett." The word "Nassac" had already been registered for the same class of goods, and the registration of "Nayassett" was refused on the ground of similarity. Soon afterward, the owner of the "Nayassett" mark made new application, accompanied by the formal consent of the owners of the "Nassac" mark. The Commissioner of Patents held that the law did not provide for agreement between owners of conflicting marks, and the registration of "Nayassett" was refused accordingly.

About two years ago a manufacturer in a middle Western city became interested in a new metal polish and decided to put it on the market. After long consultation with advertising men and salesmen, a name was selected. This name was suggestive and short, with a snap to it that made it stick in the memory. Thousands of labels were ordered and packages of the article were given to the traveling salesmen of the concern to be used in getting orders from retailers. Booklets and literature had been written and mailed, and the business was beginning to take shape when, to the surprise of the manufacturer and his associates, his application for trade-mark registration was rejected by the Patent Office for the reason that the mark had already been registered. Then followed a hasty trip to a trade-mark attorney, and a search of the Patent Office records was made. Investigation of the register showed that the same name had been registered by an Eastern concern for a metal polish some years ago. About this time, a letter arrived from the attorney of the Eastern firm, with a statement to the effect that the owner of the trade-mark considered this unauthorized use of the mark an infringement and intended to take legal action in the matter. A month or two was spent in trying to make some arrangement with the Eastern concern, with the final result that the trade-mark had to be dropped and something new devised. In this case a full year was lost, and a considerable amount of money was wasted, by reason of the failure of this manufacturer to have a search made of the Patent Office records. He made the mistake of considering the matter of trade-mark registration a small detail, and trying to attend to it himself. A competent attorney would have saved his fee a thousand times over in this case.

A trade-mark consisting of the insignia of the American National Red Cross is not registrable. This prohibition is not covered by the trade-mark law, but is one of the provisions of the act of Congress incorporating the American National Red Cross (approved January 5th, 1905). This act of incorporation states that it shall not be lawful for any person or corporation to use in trade, or for purpose of advertisement, "the sign of the Red Cross" or "any insignia colored in imitation thereof," unless such person or corporation was entitled to the use of such insignia at the time of the passage of the act. This exception, which was intended to safeguard the interests of those who had long used the Red Cross sign as a trade-mark, covers the Red Cross mark of the well-known druggists' specialty house of Johnson & Johnson, the Red Cross labels used on a brand of shoes made by Krohn, Fechheimer & Co. of Cincinnati, the Red Cross mattress manufactured by a Boston concern, and a few other users of this device. The law, as it stands, is rigidly enforced in regard to all new trade-marks containing Red Cross devices. An unusual argument was made the basis of an application for registration of a label for a cough syrup, on which the emblem of the Red Cross was printed, accompanied by the words "Red Cross." When registration was refused, the applicant sought to amend the label by striking out the Red Cross emblem, while leaving the words intact. He argued that the Red Cross incorporation act prohibited only the use of the "sign of the Red Cross" and not the words. The application was rejected on the ground that it was an attempt to evade the spirit of the law.

A trade-mark is essentially an exclusive possession. When it ceases to be exclusive, it ceases to be a trade-mark, in the true sense. It is apparent, therefore, that an ordinary word, descriptive of the goods with which it is used, cannot be set aside as the exclusive property of any manufacturer, to the detriment of others producing merchandise of the same character. The wording of the law on this point is clear, and the Patent Office is strict in its interpretation. But despite this condition, many applications, destined to be rejected, are made every year for the registration of descriptive marks. We quote here a few examples of trade-marks refused registration on the ground of being descriptive:

The word "Kantleek" was refused registration as a trade-mark for a hot-water bag. The Patent Office examiner held that the word was composed of "Can't" (misspelled "Kant") and "Leak" (misspelled "Leek"), and that it was intended to convey the idea that this particular bottle could not leak. The attorney for the applicant presented an argument to the effect that this word was composed of two German words "Kant" and "Leek," that had meanings quite different from the English words with the same sounds. This contention was too subtle for the Patent Office to grasp, and registration was refused.

The word "Naphtha," used as a name for a soap with naphtha as an ingredient, was held to be descriptive and therefore not registrable as a trade-mark, to the exclusion of the goods of other manufacturers, although the owner had advertised it extensively.

"Mello," as a mark for chewing-gum, was considered descriptive, being simply a misspelling of the word "Mellow."

(*To be continued.*)

Notes for Inventors

A Cipher Typewriter.—The cipher typewriter, it is said, is coming into vogue among diplomats and business men. It is a machine by means of which a message can be written that can be read only by him for whose eyes it is intended.

Another Safety Appliance for Aeroplanes.—In a patent, No. 1,030,312, Henry Laprise of Holyoke, Mass., presents an aeroplane which is provided with a recessed top forming pockets in which collapsible floats are packed, the floats being adapted to be released from the stowage spaces and having bottom openings so that they may be filled and expanded with air from below.

A Poison-indicating Bottle.—In a patent, No. 1,032,610, Emile A. Kern of West New York, New Jersey, presents a bottle for indicating poisonous contents, which bottle consists of inner and outer walls forming a chamber between them and a light-emitting compound in the chamber, which chamber is entirely closed and permanently confines the luminous compound in the chamber.

Primitive Lobster Traps.—If you have ever been in the lobster country, you will doubtless remember the traps, all alike and all made of laths. Laths are almost legal tender with the lobster catchers, and this fact makes a lath-laden derelict cast up on the shores of the lobster waters especially desirable. The traps are not especially secure, as lobsters frequently enter, eat the bait, and if given enough time, escape; and, possibly, some one acquainted with the conditions can devise a more efficient trap for the purpose.

Two Hollerith Machines.—Herman Hollerith of Garrett Park, Md., assignor to the Tabulating Machine Company, has just secured two patents, No. 1,030,304, for a registering apparatus, and No. 1,030,305, for an apparatus for use in tabulating systems. The apparatus presented in these systems is very complicated and is designed for use in the tabulating and registering processes which Mr. Hollerith has done so much to develop. It will be remembered that Mr. Hollerith was among the pioneers in this art especially in the designing of machines for use by the Census Office in its tabulating operations.

The Need of a Stripper for Crimson Clover Seed.—A botanist friend, specializing along agricultural lines, tells the writer that the small farmer needs an implement for gathering his crimson clover seed; that such seed is expensive and that, so far as he knows, there is no satisfactory device at present for gathering the seed on a comparatively small scale. The demand appears to be for a hand stripper of low cost which can be readily operated to harvest the seed without much loss. As the seed is expensive, such an implement would quickly pay for itself.

The Many Roads to Invention.—A well-known inventor, who for many years has invented along the same line and has made a great commercial success of his useful inventions, tells how he recently was led to make an important improvement in one of his machines. His young son asked him how the differential gear of his automobile worked. Wishing to give a correct explanation, he looked up the technical features of the transmission, and in doing so happened upon the very improvement he had hitherto been unable to complete, so that largely by accident he was able to produce a desired invention which had eluded him when deliberately sought.

Wanted a New Method of Curing Pork.—In a note from abroad, Consul Albert Halstead of Birmingham tells how the increasing use of pigskin and its tendency to advance in price has raised the question as to whether the great waste due to leaving the skin on bacon, ham and other pork products can be avoided. The English *Leathers Trade Review* estimates that there is a yearly loss of skins amounting to about $3,000,000 in the United Kingdom alone. The waste of skins is evidently unavoidable under present conditions; the difficulty is to find a method of curing that will prevent any loss of the meat if the rind or skin is removed.

Legal Notes

Disclosure and Priority.—In Hewitt vs. Weintraub (Mercury Vapor Lamps) the Court of Appeals of the District of Columbia, in affirming the decision of the Commissioner awarding priority to Weintraub, held that priority was properly awarded to Weintraub on the ground that the invention in issue is not disclosed in certain earlier applications of Hewitt, and said:

"Hence the appellant is here with the concurrent decisions of the tribunals of the Patent Office against him; and where this appears, as we have frequently said, we are loath to disturb such findings, especially where the invention is of a highly technical nature, such as this, unless it is clearly apparent that error has been committed."

Accounting for Profits.—The decision by the Supreme Court of the United States in Westinghouse Electric and Manufacturing Company vs. Wagner Electric and Manufacturing Company holds that where the infringer has sold or used a patented article, the plaintiff is entitled to recover all of the profits. Also that where a patent, though using old elements, gives the entire value to the combination, the plaintiff is entitled to recover all the profits; and that where profits are made by the use of an article patented as an entirety, the infringer is liable for all the profits "unless he can show—and the burden is on him to show—that a portion of them is the result of some other thing used by him."

Protecting the Flag.—Representative Cox of Ohio has introduced in the House of Representatives, a bill making the use of the flag or the coat-of-arms of the United States, or any pattern, imitation, or representation thereof, either by printing thereon or painting thereon or attaching thereto any advertisement or device for the purpose of gain or profit, or as a trade-mark or label, or the imitation or representation of the flag or the coat-of-arms of the United States for an advertisement, trade-mark, or label, a misdemeanor. The bill also provides that no copyright shall subsist in the flag or coat-of-arms or other insignia of the United States, or any simulation thereof. The bill also makes it a misdemeanor for any person to tear down, trample upon, or treat with indignity, or wantonly destroy the flag or coat-of-arms of the United States, and also provides for a fine not exceeding five hundred dollars or imprisonment not exceeding one year for violation of any of the provisions of the act.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

FLYING MACHINE.—G. E. THOMPSON, 199 Howard St., Detroit, Mich. This easily controlled and balanced flying machine is adapted to float on water by means that form a fluid cushion between the water and the machine, whereby the device may be raised from the water. The invention provides a supporting plane, and means for rarefying the air or compressing the air at either end of the plane for balancing the same.

Electrical Devices.

WIRELESS MEANS FOR CONTROLLING AEROPLANES.—C. L. VANDERBURG, R. F. D., No. 2, Box 48, Fayetteville, Ark. This inventor provides a simple device by means of which the movements of an aeroplane may be so controlled that it will respond directly to the will of the operator, thereby avoiding the necessity of carrying a passenger to manipulate it. He also provides means for effecting aeroplane operations in dropping bombs or torpedoes.

AUTOMATIC DEVICE FOR TURNING MUSIC.—C. DALBONI and J. MACARIO, 49 Grove St., New York, N. Y. Means are here provided for turning music in sheets or in book form; and the invention comprises a combination of actuating elements by which a sheet or page can be turned in either direction. The music is engaged with sufficient force to move it from one position to another, and the actuating arm is always returned to its original position when released. Means provide for preventing waste of current furnished by the source.

Of Interest to Farmers.

ADJUSTABLE SCRAPER.—N. D. MCCOLLUM, Gore, Ga. This improvement relates to plows and cultivators, and the aim is to provide a scraper for attachment to a plow or cultivator, and more especially designed for scraping the ground on opposite sides of the plow point and sweeping it outwardly onto the adjacent rows of plants, hills or the like.

CUTTER BAR FOR MOWING MACHINES.—C. FALK, R. F. D., No. 1, St. Paul, Neb. This invention provides a removable extension for the cutter bar to augment the cutting capacity of a mowing machine, and provides means for splicing the extension and main frame of the cutter bar which is simple, economical and efficient.

COTTON CHOPPER.—R. HAMILTON, P. O. Box 711, Pensacola, Fla. The machine covered by this patent employs disk cutters arranged in pairs, the disks of each pair converging toward the front, and in connection with the disks, cultivator shovels are employed at the rear of the machine; the invention resides in a novel construction and arrangement of the parts for raising, lowering and otherwise adjusting the disk cutters and the shovels. There is also comprised in the machine a novel arrangement of guide wheel and its controlling lever.

Of General Interest.

TUBE.—J. W. HAWKINS, 121 Union Ave., Passaic, N. J. This tube is commonly known as a paint tube, made of tin foil or similar material, for containing paint, tooth paste and other semi-fluid substances, the tube being arranged to open by pressure from the outside to govern the outflow of the tube contents onto a palette, tooth brush, spoon or like article, and to close the tube by pressure of the contents from the inside on release of outside pressure.

RACK FOR PAPER BAGS.—C. J. TABER, Bainbridge, N. Y. This rack is for use in holding paper bags of various sizes and in a manner for convenient removal of bags singly of a desired size as required by the storekeeper, and arranged to permit of placing the rack in a flat, inclined or vertical position on a counter or other support, and to allow of filling each individual holder with a bundle of bags of a size corresponding to the holder.

PROCESS FOR BLEACHING OLD PAPERS, PAPER STOCK, STRAW, ETC.—J. H. MELCHERS, McCanna, N. D. An object of this invention is to provide a process by means of which the coloring matter, ink, etc., may be removed from old papers so as to make stock of pristine whiteness. Further to provide a process for bleaching paper stock in which there are iron salts.

FOLDING CROSS.—H. T. WALROW, 66 Halsey St., Astoria, Queens, N. Y. Mr. Walrow's invention relates generally to articles of jewelry intended for ornamental purposes on watch chains, and more particularly involves a folding cross. The object is to provide a folding cross which will be pleasing in its appearance and well adapted to serve as an article of adornment.

MEASURING AND BAG FILLING DEVICE.—A. B. CROSBY, 178 Border St., East Boston, Mass. This apparatus measures out quantities of material and delivers the same to containers. It is particularly applicable for use in filling bags with coarse material, such as coal. Coal is often sold in small quantities, and this device permits of the delivery of such a small quantity of extra coal as may be necessary to bring the quantity in the bag up to the required weight standard.

NON REFILLABLE BOTTLE.—M. HORNSTEIN, 184 Warren St., Jersey City, N. J. An object here is to provide a simple closure for the bottle. The inventor attains this by constructing the neck of the bottle in two parts and by disposing a gasket at the connection between the parts, which gasket supports a float valve having a limited movement off the seat.

UMBRELLA ATTACHMENT.—T. C. FREDERIKSEN, Astoria, Ore. This invention more particularly comprehends a device designed to be secured on the handle portion whereby the umbrella may be conveniently suspended from

UMBRELLA ATTACHMENT.

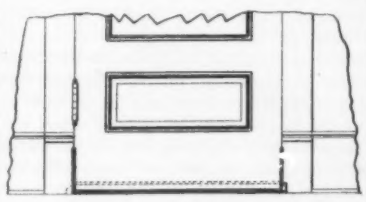
the clothing of the carrier. The device may be applied to any umbrella, and the inventor's purpose is to provide for suspending the device from the clothing when it is necessary to use the hands for other purposes, as shown in the illustration, thereby avoiding the tendency to mislay or lose such articles. The device may assume a variety of ornamental designs according to the style of handle employed.

COMBINATION TRAY AND GLASS HOLDER.—J. HERROLD, Richmond Hill, Queens, New York, N. Y. The object here is to provide a holder for use in saloons, clubs, private houses and other places, and arranged for convenient attachment to a table or other support to conveniently hold a drinking glass and support cigars, cigarettes, ashes, and matches.

FOUNTAIN PEN.—J. J. MEAD, 390 Crescent St., Brooklyn, N. Y. In this patent the invention has reference to fountain pens of that type known as "self fillers." An object of the inventor is to form a fountain pen which will be quickly and easily filled without the necessity of removing the pen-point.

VENTILATING AND PERFUMING DEVICE.—P. KILLPATRICK, 4217 W. Kinzie St., Chicago, Ill. An object here is to provide a device by means of which pure air may be supplied evenly to the various parts of a room. And further, to provide a device by means of which the natural perfumes of growing flowers may be supplied to the interior of a dwelling, hospital, or other building.

DOOR STRIP.—L. J. VALENTINE, Plainview, Texas. This invention comprehends a construction adapted to be carried by a door for engagement with the floor or sill and provides a construction wherein air and wind with any particles carried thereby may be kept out of a room. The principal object is to provide a strip to be carried by a door, the arrangement being such that when the door is open the



DOOR STRIP.

strip is out of sight, coöperating with means carried by the door whereby when it is closed the strip will be moved into operative position adjacent the floor or sill. The strip is adapted to lie closely adjacent the floor when the door is closed, even though the floor be irregular or in a different plane than that intended. The engraving shows a partial front view of a door with the casing therefor showing strip in operative position.

Hardware and Tools.

WEDGE.—W. WALTERS, Glendale, Wash. The object here is to povide a new form of wooden or iron wedge so constructed and reinforced that the wear and tear is taken off the metallic parts, and the stresses and strains incidental to an article of this character, are evenly and proportionally distributed over the whole surface.

CARPENTER'S GAGE.—M. B. MATHESON, P. O. Box 133, Duluth, Minn. The intention in this case is to provide a simple device for carpenters' use, and designed for quickly and accurately locating on a door the exact points at which to cut the openings for the key and knob of the lock, and the width and depth of the cuts for the hinges.

COMBINATION TOOL HOLDER.—W. L. HANE, care of Hocks & Duval, Ocala, Fla. The object of this invention is to provide a simple and inexpensive holder for use with lathe planer and shaper, wherein a single improved implement will perform the functions of three now necessary, and by means of which a great economy in time and labor is effected.

ENVELOP OPENER.—J. W. SINNOTT, 846 E. 146th St., Collinwood Station, Cleveland, Ohio. This invention contemplates a tool having a guide slot or passage to receive the edge of the envelop to be opened with a knife or cutter located in the guide or passageway in position to engage beneath the flap as the envelop is moved along the guide or passage, or the tool is moved along the envelop.

Heating and Lighting.

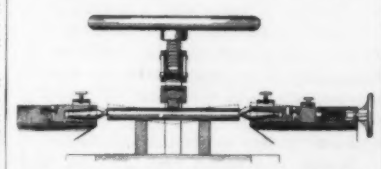
ELECTRIC GAS LIGHTER.—H. D. GRINNELL, Agricultural National Bk. Bldg., Pittsfield, Mass. This lighter has spark terminals for convenient and quick attachment to the gas burner tip without requiring any constructive changes in the tip, at the same time directing the jump spark across the burner opening to ignite the gas, and to prevent the spark terminals from being unduly heated by the gas flame of the burner.

Household Utilities.

COMBINATION SPRING SEAT AND SPRING BACK.—G. W. ROBERTSON, Mount Vernon, Indiana. This invention provides a combined spring seat and back, so constructed that the back may move from side to side in the direction of its plane, as well as laterally in a direction perpendicular to its plane, thereby to conform with the vertical or direct up and down movement of the seat.

Machines and Mechanical Devices.

STRAIGHTENING PRESS.—J. JOHNSON, 413 Gvepp St., Bethlehem, Pa. This invention straightens bars, cranks, and the like, without removing the same from their centers. Further, it arranges means for straightening the above, which utilizes the leverage action of a cam, and an even positive pressure caused by the



STRAIGHTENING PRESS FOR BARS, CRANKS, ETC.

action of a screw moving the cam. Means provide for bending bars of any desired length, the means for accomplishing this being such as to accommodate bars of certain lengths without removing them from their supporting centers, and for accommodating bars of greater length than the device, by substituting auxiliary supports in place of the centers. The engraving shows a fragmentary longitudinal sectional view through the structure.

ANIMAL TRAP.—W. A. MAY, care of W. H. HARDEN, Quitman, Ga. This is an easily cleaned mechanism wherein the entrance opening is normally open, and is closed by the entrance of the animal, and wherein other compartments are provided into which the animal may freely pass, but cannot return in order to permit the trap to automatically set itself.

MACHINE FOR MAKING STAVES.—T. G. MARTIN, 1029 Quincy St., Parkersburg, W. Va. Mr. Martin's invention is an improvement in stave machines, and has for its object the provision in a machine of this character, of new and improved means for cutting and equalizing staves, while the staves are being moved continuously through the machine.

SHAFT HANGER.—G. C. SPILLERS, Alexander Bldg., Tulsa, Okla. The improvement is in hangers suspended from ceiling plate or bracket; and the special feature is the adaptation of the hanger for adjustment of its movable members for the purpose of placing a shaft in different position as required to secure alignment or parallelism between different shafts.

PHOTOGRAPHIC SHUTTER.—J. RICHARD, 25 Rue Mélingue, Paris, France. The invention relates to shutters for photographic apparatus and more particularly for stereoscopic cameras. The shutter is characterized essentially by the fact that the movement of the leaves of the shutter, in one direction or in both, is operated by percussion by means of a mechanical device independent of the leaves themselves.

CACULATING MACHINE.—NELSON STAFFORD, 67 Fulton St., Manhattan, N. Y., N. Y. This inventor provides a machine wherein are imprinted in column form a succession of numbers, and wherein may be imprinted at will the totals of column sections, or the result of a succession of such totals; and provides means for exposing to view at will the composited number designed for addition to the column and number indicating the total of the column inclusive of the number composed for addition thereto.

INTEGRATOR FOR CONVEYER BELT WEIGHING SCALES.—W. P. BUCHAN, Box 876 Kansas City, Mo. This invention provides registering mechanism to display for record the total weight of material passed over a belt conveyer when operatively connected with the mechanism; and provides for recording accumulatively the total weight as the same is passed over the conveyer to which mechanism is attached, irrespective of rate of travel of the belt, whereby variation in the conveyer mechanism incident to load variation is instantly compensated.

Prime Movers and Their Accessories.

INJECTOR.—W. H. LOCKE, care of Simms & Enskow, Thompson Pierce Bldg., Huntington, W. Va. The purpose here is to change the construction and action of various movable parts in order to increase the positiveness of the action of said parts, and to enable the injector to be used under greater extremes of temperature of hot and cold water, as well as to increase the amount of pressure against which the injector will work.

DEVICE FOR STARTING INTERNAL COMBUSTION ENGINES.—D. E. CROUSE, Annapolis, Md. This device permits the starting of the engine through the action of a spring under tension, and the spring is restored to its original position after the engine is started. The starting of the engine is done by the movement of a rack into engagement with a pinion, with means for swinging the rack out of engagement with the pinion and causing its return to its original position, thereby permitting the pinion to turn freely with the engine shaft.

Pertaining to Recreation.

ANIMATED TOY.—A. GUND, Gund Mfg. Co., 220 W. 19th St., New York, N. Y. This invention relates to wheeled toys, and its object is to provide an animated toy which simulates an animal, such as a dog, duck or the like, and when drawn over the floor moves certain members and at the same time emits sounds similar to those emitted by the animal simulated.

Designs.

DESIGN FOR A BANK CHECK.—P. E. HASS, 51 Liberty St., New York, N. Y. One half of the area of this design for a bank check comprises a square of four double rings with bands to and from, in the center of which is a highly ornamental body of characters surrounding a center circle inscribed with the words Bank Safety Paper, and in the center of this ring is a U. S. shield and eagle.

DESIGN FOR A CARPET OR A RUG.—G. S. SQUIRES, 41 Union Square, New York, N. Y. In this exquisitely ornamental carpet or rug the border involves the design of three bands or styles of geometrical patterns. The field is flat with a heavy clustering of flowers in the corners, and a massive design for the centerpiece.

DESIGN FOR A METAL PLATE.—J. S. LARSEN and A. VALERIUS, 470 W. 165th St., Manhattan,, New York, N. Y. This is a simple and effective ornamental design comprising a circular plate, the outer edge of which is pointed by an eight-point star, the base of whose angles joins an inside ring in whose center is a diamond. Small dots or rings are arranged around the plate.

DESIGN FOR A WATER CLOSET BOWL.—J. AMISSON, care of Lambertville Pottery Co., Lambertville, N. J. In this simple and graceful design for a water closet bowl the distinctly original feature lies in the angular position of the inlet.

DESIGN FOR A LOCKET.—C. DAILEY, care of Klein & Sons, 14 Park Place, New York, N. Y. In this ornamental design for a locket the little case holds a flat disk on which is pictured an upper half image of Christ, and on the reverse side that of the full figures of the Madonna and child.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READER'S SERVICE

HARDLY a week passes but the Editor receives letters from readers of the Scientific American who ask him whether they shall send their boys to a technical school. Whether a boy shall become an engineer, a chemist or a naval architect are questions that puzzle parents. The Editor will be pleased to aid readers of the Scientific American in deciding the matter of technical education for their sons.

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VI.—Shall My Boy Become an Industrial Chemist?

By Prof. H. C. Peffer, Purdue University.

[This is the sixth of a series of articles intended to set forth fairly the business possibilities of the technical professions. The articles are prepared by men who are connected with the more important technological institutions of this country and who are for the most part prominent educators. Because these teachers have instructed hundreds of young men in the principles of engineering, they are best qualified to write upon a subject so immensely important in the future development of American manufacturing industries.—EDITOR.]

THE importance of the chemist to modern industry is daily becoming more manifest; due to recognition of this fact, his sphere has extended beyond the bounds of the strictly chemical and metallurgical industries, and he is called upon to take part in numbers of operations closed to him but a few years ago.

New opportunities lie in the fact that most of our great industrial institutions, in an effort to eliminate waste, improve their processes of production, or to find new outlets for their products, are founding research laboratories, employing numbers of trained men. One such firm has 250 men on its chemical staff; others have smaller numbers, but the significant fact is that a few years ago such a thing would have been deemed unnecessary. The result will be that the competitors of these firms will in turn be obliged to resort to systematic investigation of their processes, or fall behind in the race, with the further result that skilled chemical technologists will be in increasing demand.

This field of research is of the greatest interest to the chemist, because the greatest possibilities for the individual lie in this direction, and because our industrial development depends on its intelligent prosecution. It is not to be supposed, however, that the young college or university graduate is fitted to undertake independent investigations; in order to become a successful research chemist, the theoretical knowledge gained at college or university must be supplemented and reinforced by practical experience, and the faculties of observation and independent thought developed.

Neither is research the sole end of a chemical education; our industries are in need of technically trained executives and more intelligent supervision. In these days of large scale operations, increased attention is being given to the purchase of materials under specifications as to composition. This may mean, first, the employment of more analytical chemists, but beyond this, it means that primarily the material must be manufactured up to a given standard, which marks the passing of the old "rule of thumb" executive, and the advent of one of higher degree of technical training—the Chemical Engineer.

No mention has so far been made of this newcomer, who will share the field of Industrial Chemistry with the chemist, and who is in many respects better equipped than the latter. That the importance of the chemist has not been fully appreciated, up to the present time, at least, is no doubt due to the fact that his training has not fitted him to conduct the large-scale operations necessary in a manufacturing plant; to insure the highest degree of success in Industrial Chemistry, it is necessary to be able to carry through to a practical conclusion in the plant the principles worked out in the laboratory. This means, in addition to a thorough grounding in chemistry, additional training as mechanical and electrical engineer, the combination constituting the Chemical Engineer. The question of the proper college course for this branch of engineering has been under discussion for some time, and our attention will be directed rather to a consideration of the important period comprised in the years immediately following graduation, which exercise such a strong influence on a young man's future.

The college course in Chemical Engineering has of necessity been largely theoretical, and practical experience is necessary to the finishing of the young chemical engineer; this will come by contact with practical operations throughout the remainder of his career.

It has not been found possible to crowd into the compass of a four years course all the studies which should constitute the equipment of the chemical engineer; he will be fitted on graduation to enter a subordinate position in some industrial plant, and advance step by step, as his knowledge of details and practical experience increases. Most men stop here, but in order to make the most of the possibilities open to him, the young chemical engineer should, after a few years of practical experience, spend some time at a good university in further study. The degree which he obtains may be of little use to him directly, but his practical experience will have given him such a different point of view toward his work, that he should profit more in point of efficiency from his university than from his college course.

The necessity of starting at the bottom in industrial work is a great advantage; aside from the inevitable readjustment of his ideas as to his importance in the "plan of things," a young man's apprenticeship in a subordinate position results in habits of industry and punctuality and a knowledge of details which is not to be obtained otherwise. Criticism to which men of uninterrupted college and university training are too often open from the practical standpoint is that they fail to see the advantages of starting at the bottom in industrial work. They thus miss the intimate knowledge of details which the practical man possesses, also the advantages of contact with workmen and understanding of them, as well as knowledge of what constitutes a fair day's work.

It is essential that the chemical engineer be able to handle and deal with men, and on this rock many an otherwise good man has foundered. A term in the works is therefore advisable before completing the course of study indicated.

This may appear to be quite an ambitious schedule, but, to cite a familiar instance, it is just about what a young graduate in medicine must go through before he is competent to enter upon the practice of his specialty. Great stress is laid on the proper training for the chemical engineer, because, aside from the man himself, it is the thing of greatest importance; the leaders in this field will be those who combine practical ability with high scientific attainments, and other factors being equal, the man with the best preparation will be the most efficient.

The general question as to whether a college education is necessary to success along technical lines, is one which is frequently raised, the inference being that it is possible to secure such an education otherwise than by attending college. Granting for the moment that such may be the case, it should be possible to develop from the larger number of young men in the shops and factories at least as many efficient technical men as the colleges—which is not the case.

The question is not one to be settled by academic discussion; the test is that of utility based on the efficiency of the average technical graduate, as compared with the average non-graduate. Perhaps the most competent to pass on the question are those who come most closely in contact with both classes—the heads and executives of our great industrial enterprises; these men measure in terms of results, and their verdict comes in the shape of demand that applicants for a constantly increasing list of positions shall be technical graduates. To use another familiar instance, the sales forces of most progressive firms are now largely recruited from the ranks of technical graduates, whereas a few years ago the practical man had the field largely to himself.

For the chemist or the chemical engineer a college training is a necessity. It may be possible for a bright, determined young man, employed in some line of industry, to acquire by his own efforts a limited knowledge of the chemistry of that particular

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SEALED PROPOSALS for Improvement to Water Supply and Extension to Water Main, also for Alteration to Sewage System at Hudson River State Hospital, Poughkeepsie, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until 3 o'clock, P. M., on Wednesday, August 7th, 1912, when they will be opened and read publicly. Proposals shall be accompanied by a certified check in the sum of 5% of the amount of bids and the Contractors, to whom the awards are made, will be required to furnish surety company bonds in the sum of 50% of the amount of contracts within 30 days after official notice of award of contract, and in accordance with terms of Specifications Nos. 1545 and 12038. The right is reserved to reject any or all bids. Drawings and specifications may be consulted, and blank forms of proposal obtained at the Hudson River State Hospital, Poughkeepsie, N. Y., at the office of the State Hospital Commission, No. 1 Madison Ave., New York City, and at the office of the State Architect. Complete sets of plans and specifications will be furnished to prospective bidders upon reasonable notice to and in the discretion of the State Architect, Herman W. Hoefer, Capitol, Albany, N. Y. T. E. McGarr, Secretary State Hospital Commission. Dated: Albany, N. Y., July 15, 1912.

field; he will be competent only as long as no new problems present themselves, and quite helpless otherwise. The day of the self-made man in technical lines is past; the fields of chemistry are so wide and diversified that no man, however able and industrious he may be, is able to make much headway unaided. Competent instruction and the proper equipment for experiment are needed; the college and the university, which have specialized in this department, afford the only means open to the average young man for proper instruction.

Quirigua

(Concluded from page 97.)

9.19.0.0.0 9 Ahau 18 Mol at Quirigua is, that it is the latest date yet found at this city, and indeed for that matter, one of the very latest in any of the southern Maya centers. With the coming of Cycle 10 the great southern cities rapidly declined, and only two or three of them show dates later than the close of katun 19, which is inscribed here on Structure 1 at Quirigua.

In addition to Structure 1, a low and much smaller mound, some 30 feet southwest of it, was excavated, and this proved to be a building of the dwelling type. (See Fig. 2, where Structure 2 appears in the foreground to the right.)

This latter building was perhaps of greater interest than its more imposing and pretentious neighbor on the terrace behind. To begin with, Structure 2 is older than Structure 1. Indeed, the terrace upon which the latter stands was built *around* Structure 2, covering it up to within 6 or 7 feet of its roof. Only the north side of Structure 2, that containing the doorway, was left open. (See Fig. 2.) The covering up of three sides of this building by the terrace of Structure 1, doubtless made for its preservation; and to this fortuitous circumstance alone we are indebted for the solution of several important architectural problems. Until the excavation of this building it had been a disputed point whether the treatment of the façade above the medial cornice—i. e., the upper half—had been sloping like a Mansard roof or vertical. Both methods of treatment had been found in other Maya cities, but heretofore no façades, either at Quirigua or Copan, were standing to a sufficient height to determine this important point. In Structure 2, however, enough remained to show that the upper half of the façade sloped backward. Although this same fact could not be positively established in connection with Structure 1, because of its greater demolition, nevertheless, by analogy, the writer believes that it also may be regarded as having had the upper part of its façade sloping. Probably the same may be said of all other buildings, both here and at Copan.

Structure 2 yielded more specimens than Structure 1. A number of pieces of pottery were recovered, including a very fine painted fluted vase with a grotesque human head on one side. Many mother-of-pearl beads were found, but long exposure to the moisture had rendered them crumbly and rotten. A few jade beads were also found, but they were small and in no way worthy of note. The most unique find in Structure 2 was a series of worked hematites. These were hexagonal in shape, about one sixteenth of an inch in thickness and not over one inch in width between the two points. One side was very highly polished in each case, the other being ground smooth. The edges were beautifully cut; and some of the fragments showed a round edge, as though such pieces had formed the border of some mosaic. The purpose for which these were used is unknown; and so far as the writer is aware, nothing like them has ever been found.

An interesting feature, tending perhaps to confirm the identification of Structure 2 as being of the dwelling type, was the stone hooks which were found in the walls on both sides of every doorway. These were about four and one half feet above the level of the floor in each case, and always went in pairs, one on each side of the opening. They were doubtless used for hanging curtains across the doorways, a much needed protection in the rainy season. In some cases another pair were found on the floor level, so that the hanging could be secured both at top and bottom from flapping in the wind. These hooks always had their points upward, so that loops could be easily placed over them. Nothing of this kind was found in Structure 1. The false arch, by which *all* Maya structures are roofed,[5] was standing to the height of the capstone in this building. This type of roofing is made by projecting the courses of two opposite walls slightly beyond the courses next below them in each case, and continuing this operation until the walls have been drawn close enough together to be bridged with a capstone. From this building it was thus possible to ascertain the approximate height of the rooms here at Quirigua, i. e., about nine or ten feet.

The quarries from which the building stone was obtained are some two and a half miles west of the city. The material in Structure 1 is a sandstone of rather fine grain, while that in Structure 2 is a volcanic rock, much harder and stronger. Both were worked with stone chisels, basalt being the commonest material. Several such chisels were found during the course of the excavations. They varied from 4 to 6 inches in length, had but one cutting edge, and were shaped to fit the hollow of the hand. There was no indication that they had ever been supplied with any form of handle.

In addition to the specimens collected, the most important results of the season's work were (1) the discovery of the new hieroglyphic texts and the exceedingly important data which they present, (2) the discovery that the upper half of the façade in Structure 2 was *sloping* rather than vertical, (3) the discovery that all sculptured stones were originally covered with a coating of white lime plaster varying from a very thin slip to one half inch in thickness, and (4) the discovery that Structure 2 was of greater antiquity than Structure 1.

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A DISADVANTAGE of the electrical heating of hot water for general domestic supply is that when the temperature of the volume of water is lowered on drawing off a considerable percentage of the total amount by the incoming cold water, a long time is required to regain the normal temperature. To avoid this difficulty a form of electric heater has been devised in which part of the water only is heated directly by electrical energy, the remainder being heated indirectly by the first part. An inner cylinder contains the portion to be heated directly by an immersed resistance unit. The remainder of the water is contained in an outer jacket and receives heat from the inner cylinder through a wall. In order to allow the inner volume (from which the draw-off pipe runs) to become hot enough in a short time, the separating wall is designed to hinder the flow of heat to some extent. Thus the electric heating is applied to only one third of the total volume instead of to the whole, so that the temperature rises much more rapidly than by the ordinary arrangement.

A Polar Drift à la Nansen

ACCORDING to the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* a Spanish expedition under Señor Gisbert will embark this summer at a point near Point Barrow, Alaska, for a drift of several years in the North Polar Basin, after the example of Nansen's famous journey in the "Fram."

[5] Throughout the length and breadth of the Maya area, from Yucatan in the north to Honduras in the south, and from the Isthmus of Tehuantepec in the west to British Honduras in the east, the writer knows of not a single authentic case of a Maya building having any other kind of a roof. John L. Stephens ("Incidents of Travel in Yucatan," Vol. II., pp. 391, 392) claims that he found a flat ceiling at Tuloom on the east coast of Yucatan, but this statement has never been verified.

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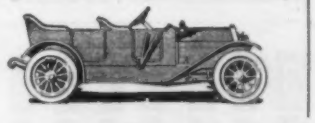

A guide to correct Automobile lubrication

Explanation: In the schedule the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example, "A." means "Gargoyle Mobiloil A." "Arc." means "Gargoyle Mobiloil Arctic." For all electric vehicles use Gargoyle Mobiloil A. The recommendations cover both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1908 Summer	1908 Winter	1909 Summer	1909 Winter	1910 Summer	1910 Winter	1911 Summer	1911 Winter	1912 Summer	1912 Winter
Abbott Detroit	...	...	...	...	A	Arc.	A	Arc.	A	Arc.
Alco	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
American	A	E	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Apperson	A	E	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Atlas	A	A	E	E	E	E	E	E	A	A
" Com'l	...	...	E	E	E	E	Arc.	...	A	A
Austin	A	A	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Autocar (2 cyl)	B	A	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (2 cyl) Com'l	...	...	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (4 cyl)	A	E	A	E	A	E	A	Arc.	A	Arc.
Benz	...	...	A	A	A	A	A	A	A	A
Bergdoll	...	...	...	...	A	A	Arc.	Arc.	Arc.	Arc.
Brush	A	A	A	E	A	E	A	E	A	E
Buick (2 cyl)	A	A	A	E	A	A	A	A	A	A
" (4 cyl)	A	Arc.	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Cadillac (1 cyl)	A	E	B	A	...	...	...	...	...	...
" (4 cyl)	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Cartercar	A	E	A	A	A	E	A	E	A	E
" Com'l	B	A	A	A	A	E	A	Arc.	A	Arc.
Case	...	...	...	...	...	...	A	A	A	Arc.
Chadwick	A	A	A	A	B	A	A	A	A	Arc.
Chalmers	...	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	Arc.	Arc.
Chase	B	B	B	B	B	B	B	B	B	B
Cole	...	...	...	...	Arc.	Arc.	A	Arc.	Arc.	Arc.
Columbia	A	E	A	E	E	E	A	A	A	A
Columbia Knight	...	...	...	...	...	...	...	...	A	A
Couple Gear	A	A	A	A	A	A	A	A	A	Arc.
Croxton-Keeton	...	...	...	...	A	Arc.	A	Arc.	Arc.	Arc.
Daimler	A	E	A	E	A	E	A	E	A	A
Daimler Knight	...	...	...	...	...	...	A	A	A	A
Darracq	A	E	A	E	A	E	A	E	Arc.	Arc.
De Dion	A	A	A	E	B	A	A	E	A	A
Delahaye	A	A	A	A	A	A	A	A	A	A
Delaunay-Belleville	B	A	B	A	B	A	B	A	B	A
Elmore	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
E. M. F.	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Fiat	A	E	B	A	A	A	B	A	A	A
Flanders	...	...	...	...	E	E	E	E	A	A
Ford	A	E	E	E	E	E	E	E	E	E
Franklin	B	E	B	A	B	Arc.	A	Arc.	A	Arc.
" Com'l	B	E	B	A	B	A	B	A	A	Arc.
Gramm	...	...	...	...	...	...	A	Arc.	A	Arc.
Gramm-Logan	...	...	A	Arc.	A	Arc.	...	...	...	...
Hewitt (2 cyl)	...	...	A	A	A	A	A	Arc.	...	...
Hewitt (4 cyl)	A	A	A	E	A	E	A	Arc.	E	E
Hudson	...	...	...	...	Arc.	Arc.	A	Arc.	A	Arc.
Hupmobile	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
International	B	A	B	A	B	A	B	B	B	A
Interstate	...	...	A	E	A	E	A	Arc.	A	Arc.
Isotta	A	E	A	A	A	A	A	A	A	A
Itala	...	...	A	A	A	A	A	A	A	A
Jackson (2 cyl)	A	A	A	A	A	A	...	...	...	...
" (4 cyl)	A	E	A	E	A	E	A	Arc.	A	Arc.
Kelly	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Kissel-Kar	A	E	A	E	A	E	A	Arc.	A	Arc.
" Com'l	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Kline Kar	...	...	...	...	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Knox	B	E	B	A	B	A	B	A	B	A
Krit	...	...	...	...	A	A	A	A	A	A
Lambert	A	E	A	A	A	Arc.	A	Arc.	A	Arc.
" Com'l	A	A	...	...	...	...	A	E	A	E
Lancia	B	A	B	A	B	A	B	Arc.	B	Arc.
Locomobile	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Lozier	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Mack	A	A	A	E	A	E	A	E	E	E
Marion	A	A	A	E	A	E	A	E	A	Arc.
Marmon	B	E	Arc.	Arc.	A	E	A	Arc.	Arc.	Arc.
Matheson	A	E	Arc.	Arc.	Arc.	Arc.	A	A	A	Arc.
Maxwell (2 cyl)	E	E	E	E	E	E	E	E	E	E
" (4 cyl)	...	...	E	E	E	E	Arc.	Arc.	Arc.	Arc.
Mercedes	A	E	A	E	A	E	A	E	A	E
Mercedes Knight	...	...	...	...	...	...	A	A	A	A
Mercer	...	...	...	...	A	Arc.	A	Arc.	A	Arc.
Minerva Knight	...	...	...	...	...	...	A	A	A	A
Mitchell	A	E	A	A	Arc.	Arc.	A	Arc.	A	Arc.
Moon	A	E	A	A	A	A	Arc.	Arc.	Arc.	Arc.
National	A	E	A	Arc.	A	A	A	A	A	A
Oakland	...	...	A	E	A	E	A	Arc.	A	Arc.
Oldsmobile	A	E	A	E	A	E	A	Arc.	A	Arc.
Overland	A	E	A	E	A	E	Arc.	Arc.	Arc.	Arc.
Packard	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Panhard	A	E	A	E	A	E	A	E	A	Arc.
Panhard Knight	...	...	...	...	...	...	A	A	A	A
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pennsylvania	A	E	A	E	A	E	A	A	...	...
Pierce Arrow	A	E	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
" Com'l	...	...	...	...	...	...	Arc.	Arc.	Arc.	Arc.
Pope Hartford	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	E	A	A	A	A	Arc.	A	A	Arc.
Rambler	A	E	A	A	A	A	A	Arc.	Arc.	Arc.
Rapid	A	A	A	A	A	A	A	Arc.	Arc.	Arc.
Regal	...	...	A	E	A	E	A	Arc.	A	E
Renault	A	E	A	Arc.	A	A	A	A	A	Arc.
Reo	A	A	A	A	A	E	A	Arc.	A	Arc.
Royal Tourist	A	E	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Selden	A	E	A	E	A	E	A	E	Arc.	Arc.
Simplex	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Speedwell	...	...	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stanley	D	D	D	D	D	D	D	D	D	D
Stearns	A	E	A	A	Arc.	Arc.	A	Arc.	A	Arc.
Stearns Knight	...	...	...	...	...	...	...	...	A	A
Stevens Duryea	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Stoddard Dayton	...	...	E	E	Arc.	Arc.	A	A	A	A
Stoddard Dayton-Knight	...	...	...	...	...	...	...	...	A	A
Thomas	A	E	E	E	E	E	E	E	A	E
Walter	A	E	A	E	A	E	Arc.	Arc.	Arc.	Arc.
Welch	A	E	A	E	A	E	...	...	...	...
Welch Detroit	...	...	...	...	...	...	A	E	...	...
White (Gas)	D	D	D	D	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Steam)	D	D	D	D	D	D	D	D	D	D
Winton	A	E	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc

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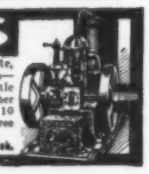

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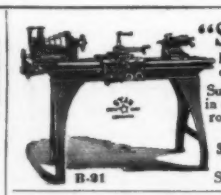
(12666) E. L. B. writes: *Re* item "An Ingenious Weather-cock," under Notes for Inventors, on page 589 of your valuable journal, I wish to advise that an indicating device similar to that referred to was described in *Amateur Work*, vol. i (June, 1902) pages 180 to 183, inclusive, four figures, under the caption "An Electric Wind-vane," by Paul M. Benedict. This device uses commutated currents in connection with "electro-magnets and compass" indicator. Also see "An Electric Wind Vane," by C. E. S., the *Model Engineer and Electrician* (London) vol. xix, No. 375, pages 11 to 13, inclusive, and No. 376, pages 27 to 30, inclusive, seventeen figures. (July 2nd and 9th, 1908.) Indicator works on the principle of the annunciator. Being interested in meteorology, I have designed an electro-magnet indicator, utilizing a soft iron armature instead of a compass needle, the armature being kept in synchronism with the wind vane by means of a special commutator, which shifts the current from closed circuit batteries through the several magnets in proper sequence. I have also used a special rheostat operated by the wind vane and in circuit with an ammeter directly calibrated to show direction. I have no desire to discourage inventive research in this particular; but as the devices enumerated above cover the field pretty thoroughly and quite satisfactorily, there is not a great deal left for the "successful inventor" to invent. A. We thank you for your interest in the matter of the electrically indicating wind vane. Your observations are quite true. There is no glory nor gold here for an inventor to obtain; but there is for the amateur who is possessed with the laudable desire to "make something." We have ourselves devised several arrangements of this sort in our own weather observations. There are always new men coming up who wish for such devices. That is of course our reason for publishing such plans as we do in our Laboratory at Home and the Workshop section. It is not that they are absolutely new or wholly original, but that these devices will meet some one's eye who is just now in want of some such thing. Any reader wishing to refer to the original description will find it in Vol. 106, No. 26, on page 589.

(12667) K. B. says: 1. What is the lightest known gas? How is it obtained? A. The lightest known gas is hydrogen. The decomposition of water by electricity yields this gas. It may be generated by the action of hydrochloric acid upon zinc, forming zinc chloride and liberating the hydrogen which the hydrochloric acid contains. When a piece of sodium is dropped into water, the gas which comes off is hydrogen. This is too expensive for commercial purposes. The action of warm sodium hydroxide upon aluminium causes the evolution of hydrogen from the sodium hydroxide and the formation of aluminium hydroxide. The first method given is the cheapest and the one most generally employed for obtaining hydrogen. 2. What kind of gas passes off in the charging of an Edison storage battery? What is its relative weight to air? A. Hydrogen is evolved in the charging of the Edison storage battery from the decomposition of water. Hydrogen is about 0.07 as heavy as air; more exactly, it is 0.0696 times as heavy as air. 3. How much will a cubic foot of gas 25 per cent lighter than air lift? A. A cubic foot of air weighs 0.08 pound. A cubic foot of a gas which is 25 per cent lighter than air would weigh three-fourths as much as air, or 0.06 pound. In air it could, therefore, lift the difference between its weight and the weight of a cubic foot of air, or 0.02 pound.

(12668) W. F. says: If it were possible to take a compass over a line where there is no declination, and reach the North Pole, would the needle turn around? That is, would it continue to point to the north after passing over the pole? Such is the result when a compass is moved around a sufficiently strong magnet. A. If an ordinary compass needle, which is pivoted so as to swing in a horizontal plane, were carried along a line of no declination to the North Magnetic Pole, it would point to the true north until the Magnetic Pole was reached. When it was over the pole it would not have any directive power, that is, it would stand indifferently in any direction it happened to assume. If it were now carried forward toward the earth's geographical north pole, the needle would be reversed, and the north end of the needle would still point toward the magnetic pole it had just left. The needles of compasses point toward the magnetic and not toward the geographic poles of the earth. If a magnetic needle is hung so as to swing in a vertical plane, and carried toward the north, its north end will turn down as it proceeds until it arrives over the Magnetic North Pole, when it will stand in a vertical position, its north end being downward toward the earth. As it is carried on toward the earth's north geographical pole, the north end of the needle will be directed more and more toward the south, the pole it has left behind it.



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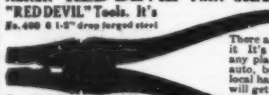

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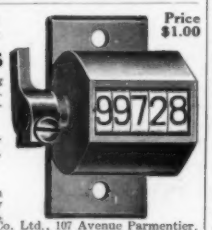

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THE OLD CLOCK BOOK. By N. Hudson Moore. New York: Frederick A. Stokes Company, 1911. 12mo; 339 pp.; 104 illustrations. Price, $2.40 net.

Those who have enjoyed and profited by "The Old China Book" and "The Old Furniture Book" will be pleased to hear of this very charming volume by the same author. English clocks are historically dealt with and described in the first of the two main divisions of the work, and American clocks and clockmakers are familiarly treated in the second division. The absence of available literature dealing with the earlier clockmaking activities of this country gives Mr. Moore's volume an added value, though the records are at best but sparse, and the products elusive. "Wag-on-the-wall" clocks were made in quantities in America up to 1830, but the author wrote forty-two letters in the effort to find an American clock of this style, without the least success. An illustration of one is given, but its standing as an American-made article seems doubtful. Speaking of illustrations, the plates accompanying the text will be a delight to all those of antiquarian tendencies. Every shape and size is here, in every degree of simplicity and ornamentation. The peculiarities indicating various makers are pointed out, and other means of identification are given. The care and repair of old-fashioned timepieces is condensed from the directions of Chauncey Jerome. A list of clockmakers, English, Continental, and American, concludes the volume.

MANNHEIM AND MULTIPLEX SLIDE RULES. By L. W. Rosenthal. New York: The Eugene Dietzgen Company, 1911. 16mo.; 67 pp. Price, 50 cents.

The slide rule is of such universal application, and is so simple to operate, once the principles are well understood, that it is extraordinary that the number of rules in use is comparatively few. The present volume tells how to use both the Mannheim and multiplex slide rules, both of which are excellent. Perhaps the most interesting chapter in the little book is that devoted to conversion ratios, dealing with geometrical ratios, ratios of length, ratios of area, ratios of capacities, ratios of weights, ratios of velocities, ratios of weights, lengths, etc., ratios of capacities and weights, ratios of pressures, ratios of work, and ratios of unit cost.

ELEMENTARY GRAPHIC STATICS. By W. J. Crawford, D.Sc. Philadelphia: J. B. Lippincott Company, 1911. 12mo.; 131 pp.; illustrated. Price, $1.

A short time ago we took occasion to mention favorably a textbook by Cathcart and Chaffee entitled "The Elements of Graphic Statics." This has been condensed and, with the matter mainly confined to the properties and general uses of the force and equilibrium-polygons, appears as "A Short Course in Graphic Statics." The "Elementary Graphic Statics" of W. J. Crawford presents another short course. Both are good, but while the first-named excels in plan and arrangement, and in some respects goes more deeply into its subject, the latter starts with simpler definitions, constructs simple apparatus, includes review questions, and will probably prove the more attractive to the absolute tyro.

CONCEALING-COLORATION IN THE ANIMAL KINGDOM. An Exposition of the Laws of Disguise through Color and Pattern. Being a Summary of Abbott H. Thayer's Discoveries. By Gerald H. Thayer. New York: The Macmillan Company. 4to.; 260 pp.; 16 colored plates and 57 black-and-white plates. Price, $7 net.

It is fitting that a book setting forth the observations and deductions of an artist should be a magnificent specimen of the typographer's art, and the publishers are indeed to be congratulated upon the result. The author defines concealing-coloration as simply that which enables the wearer to be mistaken for certain details of the scene, and his discovery—or theory, if you prefer it—is that almost every living creature reproduces in marking and tinting the background of his natural habitat. No matter how conspicuous an object he may be when removed from his own domain, while there his costuming is that best fitted to melt into its surroundings and endow its wearer with a gift approaching that of invisibility. The supreme feature of the volume is its remarkable illustration, in which birds, beasts, fishes, reptiles, and insects are shown with scientific and artistic accuracy beneath the light, and with the background, of their native haunts, where the concealing function of their markings has free play. We understand the volume was eight years in preparation. It certainly represents a vast amount of sympathetic and intelligently ordered labor, and offers much material for thought and for further trained investigation.

ELIZABETHAN INTERIORS. By C. J. Charles, London: George Newnes, Ltd. New York: F. Greenfield, 1911. Folio. 40 pp. Numerous plates.

This superb work is printed from original plates, etchings, and drawings, and the selection of them is most admirable and the plates beautifully reproduced. It is, in fact, a book which will be welcome to the libraries of all architects and connoisseurs. The text, which is beautifully set in very large type, is printed on handmade paper, the impression being sunk into it to match the plate marks of the plates themselves. It is attractively bound in morocco and boards. The purity of the Elizabethan style and its adaptability to more pretentious homes is well brought out. The examples shown include many interiors in this country. The first edition consists of 800 copies. It is one of the most attractive architectural books that we have seen for some time.

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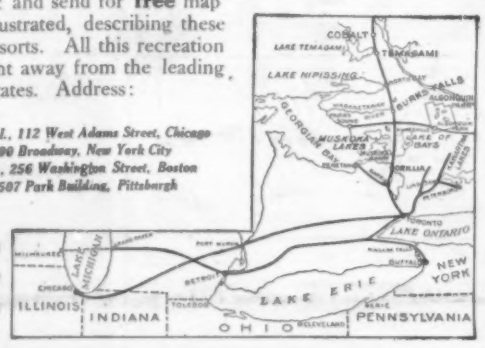

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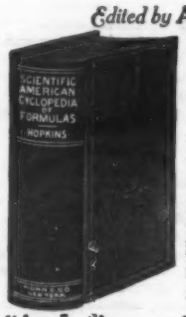

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